A Thesis, presented to the Senatus Academicus of the University of Edinburgh, for the Degree of Doctor of Medicine.

Subject - RINGWORM

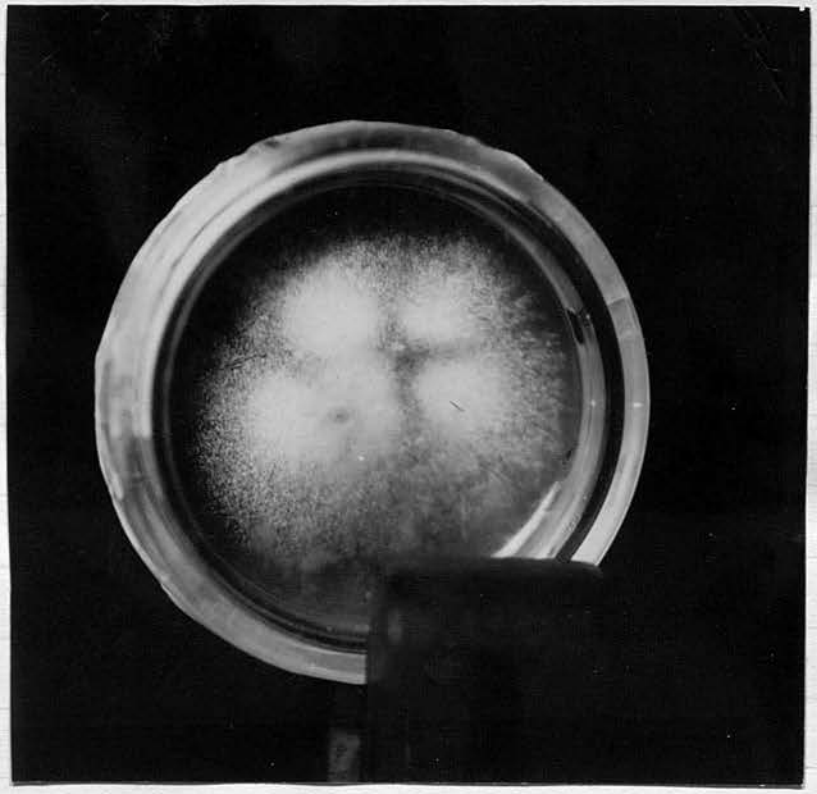
Notes and comments on 45 cases.

By

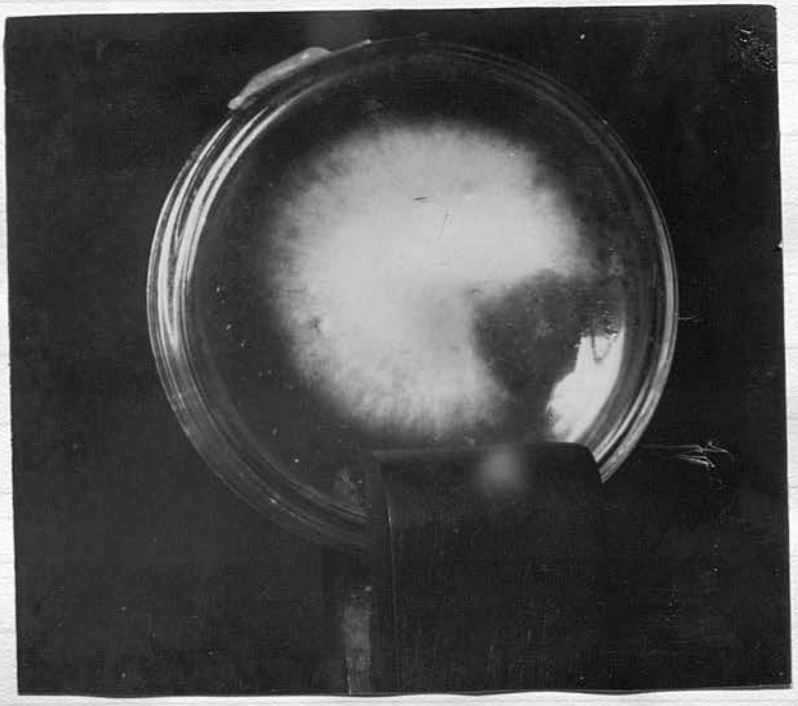
Jane Alice Craig.

May, 1902.

Photographs of Cultures.



Megalosporon endothrix - 15 days' growth, on French proof agar, at 30°C. (See A. Boulter's case page 11)



Megalosporon endothrix - 15 days' growth on French proof agar, at ~30°C. (See A. Prestige's case page 17)

Case I Endo-ectothrix

ALICK RENSHAW:- A well-grown, healthy looking boy of between 11 & 12 years of age. Hair straight; colour - dull fair.

The hair is somewhat long, and on a cursory examination, no bald places are visible on the scalp. The hair is thin over the vertex, and the scalp in this region is covered with white, powdery scales. Amongst the scales numerous diseased hairs are seen. They are unusually long for ringworm hairs ($\frac{1}{4}$ to $\frac{1}{2}$ inch), whitish in colour, bent angularly, brittle, and break off with an audible click on traction. The scalp outside this area seems smooth and clear.

After clipping the hair, a large irregularly oval patch, antero-posterior diameter $4\frac{1}{2}$ inches, diameter from side to side $3\frac{1}{2}$ inches, is seen to occupy the crown. It is circumscribed, with a raised circinate margin, and a hyperaemic base, which is covered with scales and diseased hairs as above described. On a careful scrutiny of the rest of the scalp, a tiny hyperaemic area, less than $\frac{1}{2}$ centimetre in diameter, and covered with a somewhat greasy scale is discovered. On removing the scale three or four diseased hairs are seen, and the base is slightly moist.

There is also a small irregularly shaped, slightly desquamating and hyperaemic area at the edge of

the hair, on the neck, which shows in a good light, and on very careful examination, three white brittle stumps.

The rest of the scalp is healthy.

In addition to these scalp lesions, the glabrous skin is involved as follows:-

(a) There is an irregularly shaped, superficially inflamed area on tip of nose, covered with a thin dry sero-purulent crust. The area is less than one inch in diameter and is not significant except from its position. It has not a ringed appearance.

(b) There is a hyperaemic desquamating area on left malar bone, which is faintly red at the edge, and paler in the centre. It is not circinate, and neither papular nor vesicular.

(c) There is a hyperaemic circular area about the size of a large pea covered with a thin scale, on each cheek. On removing the scale, the surface is left moist.

(d) A small hyperaemic desquamating area ($\frac{1}{2}$ in. square) on neck. - There are no patches of dermatitis on trunk or limbs.

Microscopic examination (after soaking in Liquor Potassae, B.P. strength).

On examining with the high power lens the hairs from the scalp lesions, which I had judged from the clinical appearances to be affected with the Microsporon Andouini fungus, and which opinion the low power view of the hairs rather confirmed, I was much surprised to find the large spore fungus present in great luxuriance, not only in the hairs, but in the adjacent scales also.

It soon became manifest that I was not dealing with an ordinary Trichophyton Megalosporon Endothrix, indeed the naked eye and low power view of the hairs had practically excluded this, but I found considerable difficulty in exactly locating the fungus.

Some of the hairs were crammed with large spores, sometimes in chains, sometimes disposed like fish roe. The cuticle was occasionally seen to be well preserved. In some hairs the transverse wavy lines of the cuticle focussed first, in others what seemed to be a closely fitting sheath of large round spores, comparable to a mosaic, came into focus first.

The chief difficulty was to decide definitely whether the fish roe appearance of large round spores lay within or without the hair, as the cuticle could be seen, and yet the spores seemed to focus first.

The following appearances convinced me that the sporular sheath must be transparent; and the spores chiefly external in the hairs under consideration.

A hair with a sporular sheath which had a gap in it, had, lying to one side, still attached in part, a sheet of spores, (held together by some inter-sporular substance) corresponding in size and shape to the break in the sheath, and through the gap, the cuticle of the hair could be plainly focussed, proving that the sheath was external.

In this hair, the cuticle could also be focussed <u>through</u> the sheath, though not so clearly as where the sheath was absent, and the resemblance of such parts to a swollen endothrix hair, crammed with spores, and with preserved cuticle was very puzzling.

Another hair had only portions of sheath, making the naked part look very thin by contrast.

At one point a piece of sheath was stripping off, and where its corners were unfolding, the cuticle could be plainly focussed on the surface thus uncovered.

At a different level, within the hair, chains of endothrix fungus could be seen in meagre quantity.

The fungus here was emphatically ectothrix rather than endothrix, yet two distinct methods of attack seemed to be illustrated, that probably from the root upwards, within the hair, and that from without,

in the follicle, their spheres of action being separated by the preserved cuticle.

There is of course the possibility that the fungus here seen within the hair, had entered at any level above the root, and had grown upwards from this point.

I found also a hair which was full of chains of spores, lying plainly within the cuticle, and outside the definite cuticular sheath, at the follicular end long rows of refractile spores, much larger than those within the hair, could be seen.

These unusually large spores lay 5 or 6 deep for some distance on either side of the hair, and then dwindled down to one heavy chain.

This appearance was quite distinct from that given by the bursting outwards of intrapilar spores.

Above this sheath, the hair had the typical endothrix characters. Its outline was well preserved, the wavy transverse lines of the cuticle were plainly visible, and the intrapilar spores could be seen, in chains, crowded at each side, fewer and intertwining in the centre, and also tumbling out at a fractured end.

There were some hairs which were broken at the edges, and showed in this position chains of spores which were really intrapilar in origin, as in the centre of such hairs, the cuticle could be plainly focussed. I have often seen true endothrix hairs

show this shaggy appearance when much disintegrated, the lateral aspects always breaking down earlier than the centre. Such hairs occasionally look like ectothrix hairs.

None of the hairs examined had come out in their entirety, so that I had no opportunity of studying bulbs or mycelial fringes.

I have given this case in detail, as it has seemed to me a very unusual one, having microscopically some of the features of the endothrix type of case, and some of the ectothrix, whilst clinically it differed from both. The signs of purulent inflammation which have been associated by M. Sabouraud with the ectothrix fungus were conspicuously absent; and comparing with the endothrix type, the hairs were long, somewhat hoary and brittle, and the main lesion was a sharply circumscribed and scaly one.

Microscopic examination of scales from the lesions of the glabrous skin:-

(a) The superficial crust from the lesion on tip of nose showed, after soaking in B.P. liquor Potassae, a large number of lanugo hairs dotted through the specimen, which were found to be the centres of attraction for a large spored fungus.

Many of the hairs, sometimes individually, sometimes collectively, were surrounded with a network of long luxuriant mycelial filaments segmented, and unsegmented, branched and unbranched. One long unsegmented filament had an ampullary swelling in its course.

Some hairs were seen with close sheaths, composed of rows of regularly segmented mycelial filaments, round their follicular ends, the filaments of which opened out freely towards the distal ends. The hairs themselves were intact. Scattered networks of luxuriant mycelial filaments, branching, and usually unsegmented, were also seen, apart from the hairs. In addition to these, one could see, here and there, lengths of broad segmented mycelium disposed like rosaries cast in heaps.

The scales from the cheek lesions described under b. & c. also showed lanugo hairs being attacked by a large spore fungus.

One hair had a few loops of mycelial filaments round its shaft. Another showed a few filaments traversing its adherent follicular epidermic sheath.

A thick felting of extremely fine mycelial filaments, with no visible segmentation, was also seen in a portion of one of the scales.

Scrapings from neck lesion (d) showed no fungus.

These appearances contrast markedly with those seen in scrapings from skin lesions associated with the Microsporon Andouini fungus.

Culture from hairs of Alick Renshaw.

The diseased hairs were washed in ether, and planted on French proof agar. After ten days' growth at a temperature of 30° C. each hair was seen to be thickly covered with a heap of dry creamy powder, and a lighter powdering formed an irregular halo around. The largest halo was about 1 centimetre in diameter.

No submerged hyphae uncovered by powder were visible.

By transmitted light the centre of each growth was of a deep brown colour and the surrounding halo was somewhat paler.

Microscopic examination.

Impression preparations showed large numbers of pear pip shaped spores, varying in size, some attached laterally to rods of mycelium, some free, and some in groups.

Horizontal sections of the medium and its contained fungus show a mycelium characterized by the extremely irregular and frequent bulgings of its cells.

In most of the specimens which I have hitherto examined, there has been some symmetry in these swellings, whatever their nature may be, i.e., each side of a cell

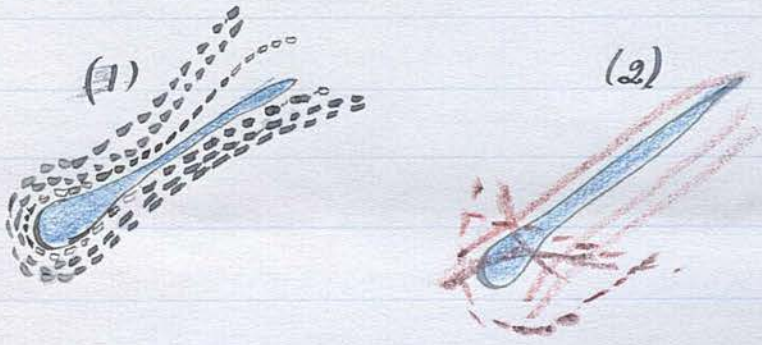
has bulged equally, and produced an ovoid or globular swelling, but in this specimen, any part of the cell wall has bulged, without an equal swelling of its corresponding part. The resulting appearance was more suggestive of pathological change than the symmetrical swellings of other specimens, and yet this culture was growing luxuriantly, and had a fair depth of medium.

No fusiform chlamydo-spores were observed.

I did not plant the scales from the skin lesions.

Out of 27 cases of ringworm examined in Worksop, from 13 different sources, this is the only one not caused by the Microsporon Andouini .

The source of infection could not be discovered.



1 & 2 are very diagrammatic sketches of Lanugo hairs from skin lesions described on pg 8.

Endothrix.

II

ARCHIE BOULTER.

Aged 5. Hair, fair and straight.

Had diffuse ringworm of the scalp - untreated. The presence of the fungus was indicated by patches of yellowish greasy looking scales which might easily have been mistaken for simple seborrhoea.

Diseased hairs were swollen, numerous, and were soft and whitish.

The fungus found was the megalosporon endothrix (resistant). In addition to the scattered insignificant areas, there were a few fairly well defined patches of the disease.

The case illustrated well the difficulty of deciding when a scalp is really free from ringworm.

When the well marked places seemed almost clear, groups of short diseased hairs which had previously eluded careful search, would suddenly come to view, and reverse one's hopeful prognosis.

Microscopic examination of the hairs -

The hairs were affected by the megalosporon endothrix. In one, the mycelial fringe was well seen.

Its component filaments pursued a straight course, showing none of that looping of the mycelium which has characterised some of the endothrix fringes which I have examined.

The cuticle was well preserved and was external to the fungus, although in a very disintegrated

hair, where the intra pilar fungus had burst its bonds, the resemblance to an ectothrix hair was at first a little puzzling. The cuticle can usually be clearly focussed in the centre of such hairs, and this dispels the confusion.

CULTURE.

The diseased hairs, planted in a petri dish of French proof agar, and incubated at a temperature of 30° C., in 15 days, were found to be covered with creamy powder, which was heaped over each hair, and disposed as a halo of lighter powdering around. No submerged hyphae could be seen by reflected light, and each colony could be separately discerned.

By transmitted light, all were merging into one, circular growth about 1½ in diameter, and with a well marked peripheral fringe of hyphae. (see photo).

Microscopic Examination.

Impression preparations showed numerous pear pip shaped spores, some free, and some attached to hyphae. The submerged mycelium showed numerous bulgings of its cells, but no fusiform chlamydospores.

This fungus is of different origin from that found in Harold Bracegirdle's case, as the boy had ringworm on admission, some nine months after H.P. developed the affection.

Endothrix.

III

CHARLES REASON

Aged 7. Hair - straight, fair.

This boy had been sleeping with Archie Boulter, before mentioned, and was examined for Ringworm at the same time. Some scaliness was observed, but no Ringworm was then discovered. About 3 months later, however, a large rounded patch, bigger than a 5/- piece, covered with small dry scales, partially bald, and showing many twisted, angular, wiry looking diseased hairs, was found.

Microscopic examination revealed the megalosporon endothrix fungus.

One hair in which the sides were crowded with rows of large highly refractile spores, showed several breaks in its continuity, through which these spores were escaping.

A few bulbs and mycelial fringes were noticed, and here the superficial mycelium was disposed in tangled loops before forming the fringe proper.

The clinical course of this case was much more satisfactory than that of Archie Boulter.

The disease remained circumscribed throughout and was, to the best of my knowledge, cured in about 6 months.

The scalp was very tolerant of strong remedies,

Amongst those used were salicylic and collodion, chrysarobin, coster's paste and croton oil.

The boy may have contracted the affection after the first examination, but it is more probable that the fungus was lurking (in the scaly areas which were noticed) in the scalp, though undiscovered at that time. If this be granted, it is noteworthy that the same fungus produced in one scalp (case II) the diffuse form, and in another the circumscribed.

Cultures.

1. Some diseased hairs from this case were planted in a petri dish of French proof agar (shallow medium).
2. Some in a tube of French proof agar.
3. Others on potato.

These three cultures were grown at a temperature of 22° C. and below this.

1. The hairs planted in the shallow layer of French proof agar, showed, after between five and six weeks growth, 4 circular colonies - diameter about 1½ c.m. Each had an irregularly shaped heap in the centre, surrounded by a circular plateau, the inner part of which was thickly powdered, the outer more lightly. From this filaments radiated to the periphery. The growth was deep brown by transmitted light. The medium in this specimen was too shallow to allow of the culture becoming crateriform, had it

tended to do so. It was contaminated by Penicillium latterly but this did not confuse the appearances much. Impression preparations showed numerous "Aaron's rod" formations, and many free spores. Many symmetrical bulgings of mycelial cells observed.

Microscop-Exam.

2. In the tube the fungus had a greater depth of soil, but it had not become crateriform by the end of 6 weeks - the growth was circular and acuminate, about 1½ c.m. in diameter, and covered With fine cream coloured powder. (The clinical aspect that of "Endothrix" was resistant)

Microscop Exam. showed Aaron's rods. The submerged mycelium showed occasional symmetrical swellings. No terminal chamydospores seen.

3. Hairs planted on potato, - very slow growth. The growth on potato was even less luxuriant than that on maltose agar. Potato had been kept moist by means of an indiarubber cap on the tube. (to prevent evaporation) After 6 weeks, two main masses of growth of a dirty cream colour surrounded the hairs. These were irregular in shape, the largest diameter being about 1 c.m. Most of the growth was dry and finely powdered. There was an appearance of satellite growths at the margin. These may have arisen from dropped spores.

Microscopical examination showed "Aaron's rods" and ampullary swellings in the mycelium.

Endothrix

IV

HAROLD PRESTAGE.

Age 5. Hair:- brown, straight.

A case in which there were scattered small patches of diseased hairs.

The hairs were short, dark and swollen.

Microscopically -

The fungus present was the Megalosporon Endothrix.

Clinically, it was a disappointing insidious case.

When the patches were apparently clear, there were numbers of short black hairs scattered over the scalp which contained no fungus.

Microscopically -

They showed a deeply pigmented distal end, an expanded bulb, and between these a bleached follicular portion.

I have often noticed these hairs in ringworm cases of both kinds and have regarded them with suspicion.

These atrophied stumps are ~~clearly~~ mentioned ~~contrasted~~ by Aldersmith in relation to ~~with~~ the somewhat similar "point of exclamation" hairs seen in Alopecia Areata.

I cannot remember having seen a fringed end, or a mid-shaft pigmented swelling, in these hairs, such as Aldersmith describes and pictures in connection with Alopecia Areata.

CULTURE.

After 15 days, on French proof agar, at a temperature of 30 ° C., a beautiful powdery cream coloured growth was seen, circular in form, and about 1½ inches in diameter, with a border of radiating fila-

ments covered with powder right to the edge.

As will be seen from the photograph*, there was a dark, damped looking portion in one quadrant which was much less powdery.

Although this culture had grown from several hairs, no individual colonies were visible.

It was quite opaque by transmitted light, and the under surface was deep brown in colour.

MICROSCOPICALLY:-

Impression preparations showed 'Aaron's rod' formations and many free pear pip shaped spores.

I have sometimes seen the arrangement of the aerial hyphae and attached spores more clearly in very thin horizontal sections of the medium with its contained fungus, taken at the edge of the growth, than in the impression preparations.

Some intercalary and terminal granular ampullary swellings were seen in the submerged mycelium.

* In describing M. Sabouraud's views, Mr Morris says "it is rare in any two cases to find the same species of Trichophyton" (often drawn from different sources.) One may note that these two cultures differ thus - In H. Prestage's case - all trace of individual colonies is lost, in A. Boulter's case, colonies may still be discerned as such. I remember however, being much struck by 3 cultures (in Dr Hall's (all a T. prog agar not all same brew (Sheffield) collection) from the same case - all cream coloured, luxuriant and powdery, but one showed diffuse light powdery (or yellow red) one a thick ciliplike rounded growth, & a third in a tube, was pleated -

V

CHARLES PEARCE

Aged 8 years. An undersized, debilitated child - Hair - brown, straight, fine.

This case acted as a sort of danger signal in the nursery, demanding a search for hidden Ringworm.

There were 3 rings of vesicles, each on an inflamed base, and each about the size of 1/-, equidistant from one another, on the crown of the head. The centres of these were not inflamed, and the hairs were not apparently affected (to the naked eye).

The case was sharply treated at first, but, although the patches did not extend, and much of the fungus was soon destroyed, the disease lingered long, and was not really cured when I saw it last, 10 months after its discovery.

This case was memorable in that the glands draining the scalp became acutely inflamed and pus formed, after the use of croton oil. Erysipelas still further complicated matters, but happily it was readily checked by Ichthyol applications. The child was isolated as soon as erysipelas was diagnosed and no other case developed. Where it came from I never discovered.

To what extent croton oil was responsible for this sequence of events, it is difficult to say. The oil was applied with a needle, and to only two of the areas. The hair follicles of these were not destroyed.

Also, the adenitis developed when the inflammation of the patches was subsiding.

Microscopically, the hairs showed typical Megalosporon endothrix infection.

After soaking in Liquor Potassae, they appeared as very swollen, short, yellowish brown, stumps.

They were crammed full of large refractile spores, arranged in chains, and even on very disintegrated hairs one could focus the transverse wavy lines of the cuticle.

CHARLES PEARCE continued

I found a patch on this scalp about the size of a 3d piece, slightly bare and powdered with dry seborrhoeic scales, amongst which were short, greyish black, atrophied hairs.

I feared lest it should be a fresh patch of Ringworm, but it was not. The hairs showed short, intra follicular portions, and expanded bulbs, but no spores. The patch gave no further trouble.

The occurrence of this aggregation of atrophied hairs in two Ringworm cases, (Frank Fuller's (page 92) and this) and of the scattered atrophied hairs in many of the cases, is interesting.

I do not remember that any of the scalps showing these hairs were affected with ordinary seborrhoea capitis. In this connection, however, perhaps I should mention a case not affected with Ringworm, where I suspected a greasy patch on a child's temple, which contained diseased looking curly hairs, (hair naturally straight) of being Ringworm, but could find no spores, either before or after staining, though the hairs were obviously disintegrated. This negative view was confirmed by the fact that the patch showed no signs of scaliness or short hairs after a week without any treatment.

It is of course possible that many scalps not under observation may contain such hairs, and they

may have no connection with Ringworm. Indeed, I see that Dr. Norman Walker classes the atrophied stumps seen in Ringworm, Seborrhoea, and Alopecia Areata together. I infer from this that the present state of knowledge concerning them is that they are merely symptomatic of atrophy, and not pathognomonic of any one disease.

My cases have borne no resemblance whatever in clinical appearance or course to alopecia areata.

Hairs from this case were planted on shallow French proof agar (in a petri dish) and incubated at 30° C. for 18 days.

The individual colonies of growth had blended indistinguishably and produced a circular, creamy-yellow coloured, light growth, about 1½ inches in diameter. The centre was definitely powdered, The peripheral hyphae looked like a thick yellowish fluff. There was one small point of contamination, but it was discrete, and not a fungus.

Impression preparations and light scrapings of the surface fluff showed long chains of highly refractile spores, both round and square. The above surface growth contained very little unsegmented mycelium.

Specimens of the submerged part of the culture showed a dense weft, composed of a mycelium, which was crowded with ampullary swellings, intercalary

and terminal. Much deep yellow granular pigment was found, in the swellings, and free.

The chains were seen to be in continuity with the mycelium bearing the ampullae. The transference from plain, unsegmented, mycelium to large round refractile spores of very variable size, was plainly seen. The hairs were the centre of and were inextricably blended with the growth described. The chains were fairly stable, not readily breaking up on pressure, and there were very few free spores. These appearances were so unexpected that I examined the hairs from which the growth had taken place but could find no favus filaments.

Amongst some drawings of the Trichophyton, Dr. Leslie Roberts has portrayed one (presumably from a culture) described as "resting gemmae or sporiferous cells" in which he shows a chain of round spores situated between, and in continuity with two pieces of unsegmented mycelium.

I have described this culture as if my results are true, it is interesting.

If it be a case of "favus with trichophytoid lesions," it is remarkable that the hairs showed endothrix infection.

If "resting gemmae or sporiferous cells" occur in a trichophyton culture occasionally, why may not they be produced abundantly, and give appearances

Favus.

such as my culture gave.

In favour of a fallacy being the explanation, however, I must admit that I had a case of favus in the institution, hairs from which gave a culture, which I could not distinguish microscopically from an endothrix culture. The hairs from the two cases were not planted on the same date, and I had no suspicions of error until the microscope was used. The favus case was sent in as an "eczema", and had been under treatment of various kinds for a considerable time, before typical scutula developed. Many of the specimens seen under the microscope from this case were indistinguishable from a luxuriant endo or ecto thrix ~~infection~~ fungus, but typical favic filaments were also seen in some of the hairs. The case had gone on for years before I saw it, probably undiagnosed, as favus is so rare in England, and the scalp was extensively atrophied. There was only a fringe of normal hair. After persevering epilation of a portion of the scalp each day, for some weeks, and parasiticide injections, the case surely and rapidly progressed towards recovery. The diagnosis was difficult, until the scutula developed.

Endothrix.

VI

LEIGHTON BARRETT

Age 10. Hair - dark brown, straight, coarse.

This boy had a large patch of Ringworm on one temple which, after months of treatment was cured. His head was thickly covered with hair, and the scalp appeared quite healthy.

Some time after his discharge, I found on close scrutiny, one very tiny scaly patch containing 3 or 4 diseased hairs. This was easily cured, and no other lesion was discovered.

About six weeks passed, and on searching again, I found an isolated pustule with a scab. A drop of pus and blood, and two tiny curled up hairs were found under the scab. These hairs were quite disorganised, and contained chains of large highly refractile rounded spores, which easily fell apart. The pustule was only two or three m.m. in diameter, and there were no loose hairs round it.

There was a second scaly spot found, two or three m.m. in diameter (my notes do not say whether there were diseased hairs in this or not).

Besides these two exceedingly small places, not another diseased hair could be found in the scalp. If the fungus had been present in the scalp since the last examination, its power of lying dormant is shown by the minuteness of the scalp infection accomplished.

On the other hand, if these areas were the result of a fresh infection, the case illustrates the earliness of hair invasion.

Without a previous tedious experience of the insidiousness of the disease, I should never have suspected an isolated pustule, on an otherwise healthy scalp, of having any connection with Ringworm.

VII Ichthyosis - Endothrix.

ARTHUR TYSON

Age 8 years. Hair - scanty, straight, brown.

Has ichthyosis in moderate degree. Skin and scalp always dry and scaly unless inunction of oil used.

He is not subject to a moist catarrh of the skin. Reported 3 years ago as having long standing Tinea tonsurans. How long this existed is not known but in March 1901, a very small patch of scalp Ringworm was discovered.

The fungus present was the megalosporon, probably the endothrix. The attack was mild, and soon responded to treatment. He also had a small patch of Tinea circinata on one cheek. I mention the case merely to show that it is possible for the Ringworm fungus to live on a scalp affected by ichthyosis.

* Dr. Leslie Roberts says, in describing the precess of infection of a scalp, that the spore or portion of thallus becomes attached by means of oily secretion; that oil and the watery saline secretion of the sweat glands afford the first nourishment; and that if the surface fat is scanty, or the secretion of the scalp too acid, the spore dies.

*("Fungi - parasitic on Man.")

Endothrix.

VIII

STANLEY PRESTAGE.

Age 6.

Hair, fair, straight.

A case of disseminated megalosporon endothrix.

The croton oil treatment in this case was the most effective one. After its use the diseased hairs previously hidden amongst the healthy, could be picked out as swollen, translucent, and deeper in colour than their normal neighbours, and they could be extracted entire.

There were in this scalp small discrete patches, as well as scattered stumps. I found chrysarobin ointment inunction a help in keeping the patches clear, after epilation of the obviously diseased hairs. However clear it might look for a time, I could not say that it was really cured when I left it.

Endothrix

IX

CHARLES WARD.

Age 5. Hair - dark, fine, straight.

A case of disseminated megalosporon endothrix with flat, rounded, ill defined patches, containing intangible black stumps; scattered through the scalp.

Microscopically - Very long chains of large spores indistinguishable under the microscope from some seen in favus, though clinically the case had not the remotest resemblance to that disease. Some odd spores looked as if laterally placed.

No treatment, save loosening the hairs with croton oil and then extracting, seemed to touch the disease in this scalp.

The stability of the chain formation here is unlike the microscopic appearances described in the "fragile" variety of the endothrix fungus.

There was no culture to settle the question, if, indeed, one would have done.

Endothrix

SAMUEL Mc.MAHON.

Age 6 years. Hair; dark, straight, coarse.

A case of disseminated Megalosporon endothrix. The scalp was one which showed irregularly distributed superficial scaliness before treatment.

It is notable as one of the very few cases in which I have seen croton oil produce a deep folliculitis. After its use, somewhat indurated pustules formed, from which little pus could be expressed.

With a few days of poulticing, the hairs would come out and the part flatten down, remaining bald for a time. It was a very tolerant scalp, and the patches treated were, I think, cured, but there were so many of them, that the task was comparable to trying to rid of dandelions a field abounding in these by rooting them out individually. One might almost carry the analogy further, and think of the dandelion seeds blowing about the field, while one plodded on with individual roots (though there should be no loose living spores on the scalp surface, in a properly treated case).

This much I must grant to the croton oil - it accomplished something, other treatment nothing.

This scalp had chrysarobin and vaseline (one drachm to the ounce) rubbed in to it all over for ten minutes, twice a day for seven days, without inflaming it.

The culture results from this case have been meagre in the extreme. Hairs planted on French proof agar, and incubated at 22° C., and below this, showed after a month a raised cream coloured growth covered with downy aerial hyphae the largest diameter of which was only ½ a centimetre.

Microscopically - Nothing notable seen. A second culture was even less successful. (The hairs were from a treated scalp).

Endothrix

XI

HERBERT GATEHOUSE.

Age 5. Hair - light brown - straight.

This boy had two patches of scalp ringworm when first noticed.

A round, raised, inflamed patch a little larger than a 5/- piece, crowded with diseased hairs, and insignificantly scaly, and a second small round patch. He was reported to have suffered from ringworm (variety not mentioned) two years before, and to have been cured.

I cannot say whether the outbreak was a relapse or fresh attack.

The disease was limited to these two areas for several months, and with persevering treatment, the number of affected hairs was steadily reduced.

After an attack of measles (in the Spring) three small inflamed moist areas were noticed on the vertex, which closely resembled impetigo, but proved to be fresh ringworm. They were treated with croton oil, followed up with epilation, and subsequently inunction of chrysarobin ointment; by which means the parasite was readily destroyed at this early stage.

The fungus present was the Megalosporon endothrix.

The hairs generally broke off in the follicle, but a few were extracted entire. One of these showed a well marked, long mycelial fringe which had loopings

in its course, that I have not observed in Microsporon cases. The clear outline and the remarkable preservation of the cuticle even in very disintegrated hairs were typically seen.

CULTURE: - After at least 4 weeks' growth on maltose agar at a temperature of 22° C. and below this, three circular growths each about 1 centimetre in diameter heaped in the centre, covered with creamy fluff, and with a border of submerged mycelial filaments were seen.

'Aaron's rod" formations seen with impression preparations. Mycelium characterised by extremely irregular and numerous swellings of its protoplasm.

Endothrix

XII

JOHN HOLMES

Age 3 years. Hair - brown, straight.

When first observed, there were five patches varying in size from a 3d to a 6d piece, scattered through the front part of the scalp. The patches were covered with small dry scales and broken hairs. They showed little redness and the lesions were so insignificant that the disease was only discovered when examining the heads, after a case had been found in the nursery.

The hairs generally broke in the follicle, and the tops only, like bits of rotten cotton, came away in the forceps.

Microscopically. Typical endothrix infection seen. Hairs so crammed with large spores, that chain formation was not evident until the hair was broken up.

I found the croton oil treatment, walling round the patches with lanoline, and poulticing, very effective, and not at all drastic, in ridding the areas of diseased hairs, but with the foe in ambush it is exceedingly difficult to say when the scalp is really clear.

Often such cases are in a chronic condition of being <u>almost</u> well, perhaps only one or two bad hairs being found at each examination, but with the extermination of these one or two others reveal themselves.

Endothrix

XIII

LESTER SHAW

Age 2 years.

Hair fine, fair, straight.

The scalp lesions in this child were very insignificant, consisting of small patches of seborrhoeic looking scaliness, with some diseased hairs, the whole overgrown by healthy hair.

The hairs were swollen, sheathless, fairly long, and duller in colour than the normal hair. Microscopically - they were found to be crammed with long chains of rectangular spores.

The outline of the hairs was well preserved, the spores being entirely within the cuticle. Clinically - This scalp was very easily inflamed, and I found the white precipitate ointment more useful than any other. Tiny vesicles and pustules on the areas were a frequent complication. There were numerous short, black tipped hairs scattered through the scalp - which contained no fungus but were similar microscopically to those described more fully elsewhere.

Culture - Some of the endothrix hairs were sown in nutrient broth, & after a month's growth at a temperature varying from 22° C. to that of the room, were

found enveloped in a jelly-like mass lying at the bottom of the tube. When floated up, this was seen as a nearly spherical growth about ½ inch in diameter surrounding the hairs, somewhat dense and yellow in the centre, and with a fringe of long silky mycelial filaments.

Microscopically. The only satisfactory way of seeing this specimen was at the edge of a hanging drop preparation. If lifted on to a slide, the filaments clung together and were only evident as a tangled mass.

Long, luxuriant filaments were seen at the edge of the specimen. Ampullary swellings were noticed in the mycelium, some of which were terminal.

A curved filament, bearing irregular processes on its convexity was seen, which resembled somewhat the denticulations observed in microsporon cultures. As the growth was submerged, no aerial hyphae were present. The broth remained clear throughout the period of observation.

Endothrix

XIV

NATHANIEL LOVERIDGE Aged 9 months.

Hair - very fine, scanty, fair.

This case is interesting chiefly on account of the age of the baby.

The disease was much less conspicuous than many cases of Seborrhoea in infants and would probably have escaped attention but for the occurrence of other cases in the nursery.

There were a few big greasy scales hiding a few diseased hairs, the whole diseased process being obscured by the longer silky hair in the vicinity. The surface below the scales was hyperaemic.

Microscopical examination showed crowds of Megalosporon spores in the hair, and luxuriant Mycelium, long and short - thick and thin - segmented and unsegmented - branched and unbranched - lying amongst the scales. In one hair which was about ½ c.m. long, the bulb showed no disease, but a little way up the shaft the hair bulged, the cuticle was lost and many spores were bursting out at the sides.

Chains of spores spread up and down the hair from this place. Further up there was another apparently healthy portion of hair, but nearer the distal end.

A second breaking out from the cuticle was seen. Towards the broken end the spores were again confined within the cuticle and finally chains of spores

issued from the fractured end. The apparent healthiness of the extreme follicular end here (my diagram has four spores in a chain near the bulb, but these have probably adhered during removal from the scalp) rather negatives the view of the root attack in Endothrix. The point of attack seemed to be at the place where the cuticle was first lost and from which the chains of spores coursed up and down the hair.

Microsporon - from here onwards.

XV

RALPH GRAHAM.

Aged 4. Hair, dark brown - straight, coarse.

This case was to me practically an introduction to the study of acutely spreading ringworm.

When first noticed, there was a patch about the size of a shilling, on which the scalp was dirty looking, slightly scaly, and showed diseased hairs. These were principally broken off, but some were bent at an angle indicating the probable point of fracture. Some of the hairs were white, some dark with sheaths.

As the diseased area was circumscribed, and small, I regarded the case hopefully, and treated it severely that it might be stamped out before extending.

Vaseline was applied to prevent the debris from spreading and the patch was scraped to clear away as much fungus as possible. The base was slightly red and raised. I then epilated the patch, and the surrounding hairs for a distance of about ½ inch from its margin.

The parasiticides used were Glycerine and Formalin equal parts - 40% Formalin pure, and chrysarobin dissolved in liquor gutta percha.

A slough formed after the use of Formalin, which was removed, and the patch again painted with chrysarobin in liq. gutta percha.

On the removal of the latter crust, all the diseased hairs came with it, and the area was left bald, hyperaemic and somewhat depressed below the level of the surrounding scalp.

It is not very clear from my notes whether this result was produced by the formalin or the chrysarobin in liquor gutta percha. It may possibly have been contributed to by both.

I feared lest the patch might be permanently bald, and ordered the neighbouring scalp to be massaged in order to improve the circulation in this area.

The child was at this time isolated with measles.

No change in the scalp was noted, until one day some 5½ weeks after the first patch was observed, when I was very much surprised to find that the disease had spread with an almost incredible rapidity over a large area of the glabrous and hairy skin.

There were three circinate patches on the left temple and brow, their sizes being respectively equal to those of 1/-, 6d. and 3d. pieces. The edge was raised and red, but not vesicular, part of the disease being in the hairy scalp and part on the brow.

There was a similar patch, in size intermediate between 6d. and 1/-, on the right temple, and still another large irregularly shaped inflamed patch on the vertex.

Three days before I had seen nothing of this extension.

Why the fungus should have remained localised for a month, and then should suddenly extend its borders in such a way, I cannot explain.

Whether the ebullition of energy was due to the fungus having arrived at its time of Spring (it occurred in May) or to the scalp having suddenly become more conducive to its development can only be conjectured.

The spread was not coincident with the height of the febrile disturbance consequent upon the invasion of measles, or one might have attributed it in part to the higher temperature of the scalp.

The original patch gradually became thinly covered with fine, soft, silky hair, and its surface was levelled up to the surrounding scalp.

The fungus had evidently extended from some undestroyed spores in the edge of the old patch, as a ring of the disease encircled the original site of its establishment on the scalp.

Vaseline on lint was applied to protect the now healthy centre and the ring was treated with croton oil and poulticed. The reaction to the croton oil did not extend beyond the ring of its application, and the new hairs were not destroyed. (Only this one ring was treated with croton oil.) After a time there was no

further spread, and its ravages staid, the disease began to yield to treatment. I found that the following treatment was very efficacious in this case, and though painful at the time of application, the child was happy within 10 minutes and remained so up to the time of the next application. With some children the treatment would be quite inapplicable. The patches were epilated as far as practicable. At first this was not of much value as the hairs were so rotten with fungus that they could not be extracted entire, but merely the tops broke off in the forceps.

The affected areas were rubbed with B.P.liquor potassae and then with glycerine and formalin. Lint thickly spread with vaseline was then applied to prevent the formation of a hard scab. Under this treatment the number of hairs diminished very rapidly and as the hairs became less diseased they could be extracted entire. This meant much as 3 m.m. of hair or more might be buried in the follicle. The hairs grew very rapidly and at first were dead white, attenuated and friable.

A strip of scalp bordering on one of the acute ~~spreading~~ patches was epilated, and rubbed with glycerine and formalin. It did not become infected, but whether this was due to the precaution, or whether the defining limits were already set by some unknown factor, I cannot say.

There was a circular area in the occipital region about an inch in diameter which was inflamed and moist for several days, and which was difficult to distinguish from the acute ringworm, but no diseased hairs were ever found in it, and it resumed a healthy appearance without further development, the hair over it being somewhat thinned.

The diseased hairs from this case were typically affected by Microsporon Audouinii fungus.

Many of those extracted entire showed well marked mycelial fringes, and bulbs. The bulbs were but lightly scattered with small spores, as if these had been attached in the process of extraction. Some of the small spores showed a linear arrangement on the bulb, probably also due to extraction as some authority has suggested. There was no closely investing sheath of small spores for some distance from the bulbar end.

The mycelial fringes in their upper part intertwined wavily but formed no definite loopings such as I have noticed in some endothrix fringes. I did not discern really ovoid endings, but filaments seemed to end somewhat bluntly.

No culture was made from the hairs of this case.

Whilst considering this case, it is interesting to refer to a case of sudden spreading mentioned by Aldersmith. It is that of a little girl who had a

small spot of ringworm (presumably of Megalosporon endothrix resistant) behind one ear. This spot remained quiescent for two years and then suddenly spread over the scalp, though it had not been treated for a long time.

Dr. Aldersmith makes the comment "If strong measures had been used at first, much trouble would have been saved." (Ringworm and Alopecia Areata, p.43).

My experience of the case just described inclines me to think that there is an unknown element in spreading over which we have no control. There was no evident continuity of disease between the old, and several of the new patches, so far as I can remember. It is possible that a new infection took place from some outside source.

I have cited elsewhere a case of tinea circinata occurring in the scalp of an adult, without involving the scalp hairs. The behaviour of the foregoing patches of tinea circinata on the border of, and in the scalp, in a child, offers a striking contrast, weary months of treatment being necessary to overcome the invasion so rapidly established. I found only the microsporon fungus in all the hairs which I examined.

Dr. Aldersmith mentions that he has observed in the Spring, rapid growth of the fungus in some chronic cases which had lain dormant through the Winter.

I have noticed a few such coincidences of rapid extension of disease in Spring, if indeed it be only coincidence.

XVI

MINNIE WOOD.

Aged 9 years. Hair - fair, straight.

There is a round, sharply circumscribed, raised area on the left temple, just bordering on the glabrous skin, about the size of a 5/- piece, covered with dry honey coloured scabs. It is raised from ¼ to ⅜ of an inch above the level of the surrounding skin, and has more the appearance of a new growth than a patch of ringworm. On removing the crusts, the surface is seen to be moist, of a deep pink colour, and shows some gaping hair follicles, and a few white twisted hairs. On pressure, pus oozed out from several places. There was no fluctuation, but instead a feeling of bogginess. The surface was very tender. The disintegrated hairs projected only a few millimetres above the follicles, but on gentle traction some of them were removed apparently entire and measured from ¼ to ½ an inch. The rest of the scalp was healthy. I found no ringworm in the other children. There were three sisters aged 13, 10 and 6 years respectively, and one brother aged one year - all fair haired.

Clinical Course. The treatment adopted was the application of linseed poultices, and when these were removed, vaseline. The poultices were continued for three or four weeks. The lesion was very slow in resolving, remaining somewhat boggy for about a month. The remaining hairs were carefully

extracted from time to time; and when the surface had flattened down, white precipitate ointment, B.P. strength, was rubbed into the skin.

At the end of six weeks, the surface was flat, dry, deeply hyperaemic, and finely pitted. Fine downy hairs could be seen here and there. The sharply defined hyperaemic circular area was most conspicuous even at this time, and appeared to have a ring of glabrous skin right round it, the severity of the inflammation having possibly destroyed, or at least deterred the growth of some of the bordering hairs.

The history given was that the child had had an "ordinary" ringworm, which had been treated by the chemist, and had, under his treatment, taken on this alarming appearance. The ointment in use was said to be the dilute citrine ointment of the Pharmacopoeia.

The sharp limitation of the inflammatory process seems to point to some intrinsic reaction of the fungus affected portion of the scalp, as in the reaction to irritant treatment seen in most cases, such definition is quite lacking.

Microscopic examination of the diseased hairs.

Some of the hairs showed a rather unusual appearance. In one hair particularly, I noticed that the expanded bulb was covered with a closely fitting and apparently complete sheath of small round spores, while

the constricted portion above the bulb showed no spores, and its cuticle could be well seen as transverse wavy lines. Just above the neck, a mycelial fringe was clearly seen, composed of separate wavy filaments, not intertwining, but ending individually.

Besides this main mycelial fringe, a few broader filaments were found, with blunt ends, hanging out of the bulb itself.

On a more careful scrutiny, a few stray filaments could be seen traversing the neck, but these broke into rectangular segments, and I could not trace any direct continuity between the fringe in the neck of the hair, and this additional fringe in the bulb. The appearance suggested the possibility of an attack from the bulbar end, as well as that nearer the mouth of the follicle. The majority of these hairs showed part or all of the bulb, and in some, bulb and neck seemed quite free from fungus, the attack having taken place at a higher level.

The typical mosaic sheaths varied much in point of starting, and in length.

Only the Microsporon Audouini fungus was found.

The hairs were not sown - No culture.

Whilst considering the subject of Kerion in Ringworm, I should like to mention two cases which are of interest in this connection.

XVII

HANNAH BLAGG Aged nearly 10 years.

Hair - straight, dull, fair.

The scalp shows several areas in the neighbourhood of the vertex which are atrophied, depressed below the level of the healthy scalp, and denuded in part, or entirely, of hair.

The largest denuded area is about 2½ inches in its longest diameter, and the diameter of the smallest measures about ½ inch. These areas are irregularly shaped, not circular, not polished looking, and their tint is more pink than that of the normal scalp.

The scalp in these areas is inelastic, and has little or no subcutaneous fat.

On the largest patch there is a considerable growth of very fine lanugo like hair, more curly and less lustrous than the healthy hair. It can be pulled off almost painlessly, breaking readily, or having only a feeble anchorage in the scalp.

The irregularity of hair formation is seen also in a few hairs which are coarser and darker than the healthy ones.

The Mother stated that the child had had Ringworm three years ago, and that afterwards abscesses had developed on the Ringworm sites. She was taken

to a Doctor for treatment and he ordered poultices. With the poulticing the "abscesses" gradually resolved. They were not opened and no treatment save poultices was employed by the Doctor.

Before the formation of these "abscesses" the Mother had herself treated the Ringworm. Domestic treatment of Ringworm is generally gentle, and I think one may safely conclude that nature was responsible for the violent curative? effort.

This view of the etiology of the atrophied areas is confirmed by the case of a second sister, Blanche, who was said to have had Ringworm at the same time as Hannah.

XVIII

BALNCHE BLAGG Aged 7.

Hair cut a week ago on account of impetiginous Pediculosis Capitis. (This condition complicated both cases but for the sake of clearness I will not detail the lesions here.)

Before that date, Mother states that hair was long and thick. Child attending school regularly until excluded on account of this affection.

On close inspection a hyperaemic area 4½ by 3½ inches in size, irregular in shape, and with no definite edge, is seen to occupy the crown of the head. The scalp in this region is dry, plastered here and there with ~~dried~~, superficial, white, glistening

scales and crusts of dried pus.

The hair is dull fair in colour all over the head. It is thinned over the patch in question, and a few long, very dull looking, and somewhat brittle hairs can just be distinguished from the healthy hair.

No typical stumps can be found, even with the head in a good position as regards light, and examining with a lens.

The Mother states that this patch was, when the seat of Ringworm, quite denuded of hair, and that she thought the Ringworm was cured, because the hair had grown again, although the scalp in this place had never resumed quite a healthy appearance, but was always "shalified."

A microscopical examination of the lanugo like hairs from the atrophied patches of Hannah Blagg's scalp showed them to be only $\frac{1}{3}$ or $\frac{1}{2}$ as broad as the natural hairs, but no trace of fungus could be seen either in them, or in some other suspicious looking hairs from different parts of the scalp.

It seems evident from this that the process of Kerion had affected all the patches of Ringworm, and, in time, and with the permanent loss of much hair, had finally affected a cure.

The only disease which could per se have pro-

duced areas of the above description and distribution is, so far as I know, Ringworm with Kerion. Favus leaves much scarring in neglected cases, but the scalp is facetted in a characteristic way, quite absent in the case described.

The long brittle hairs taken from the scalp of Blanche Blagg proved to be typically affected with the Microsporon Audouini fungus. Many of these hairs showed well marked mycelial fringes composed of long tapering filaments. The longest diseased hair found, measured almost $\frac{3}{4}$ inch (1 c.m. $8\frac{1}{2}$ m.m.) This is the longest Ringworm hair that I can remember having seen.

The very long Ringworm hairs were but sparsely clad with spores. Twisting, irregular, lengths of mycelium could be focussed on them and the cuticle was entirely gone.

The Mother had no suspicion that Ringworm still lingered in this child's scalp, and no precautions with regard to towels, combs, brushes or sleeping arrangements, had been taken.

Notwithstanding the exposure to infection, no Ringworm was discovered in the other members of the family. I examined one young boy and 4 girls, including the two cases described.

It is probable that the fungus in these two members of one family who had Ringworm together, was the same; viz: the Microsporon Audouini. In one case Kerion had supervened; in the other no such process had occurred, and the disease had continued up to the time of observation, i.e. 3 years. The nature of the fungus associated with such a virulent Kerion is interesting in connection with the discussion as to the etiology of Kerion.

The impetiginous complication obscured the condition in these cases. The attendant folliculitis loosening some hairs in the scalp which was not at this date affected with Ringworm, and making them appear suspicious. Also there were some circinate impetiginous lesions of the glabrous skin in a younger brother which might have been mistaken for tinea circinata.

XIX

BABY HARTLEY.

Aged 8 months. Hair - fair, fine, scanty.

There is a round patch as big as a penny, not obviously inflamed, in the occipital region, covered with fine yellowish greasy scales. Near this are one or two insignificant satellites less than ½ a centimetre in diameter.

The case has not been treated, and I have seen it occasionally for several weeks, but have noticed no extension during this time. No diseased hairs could be obtained until the patches were scraped, when tiny curled white atrophied hairs were found amongst the scales.

Microscopically - typical, Microsporon infection seen. It is noteworthy that a scale from one of the small satellites contained fully diseased hairs

Dr. Adamson says:- "The earliest lesions on the scalp are those mentioned as small scaly patches. These correspond exactly in appearance with the lesions found on the body, and, as will be seen, the fungus at this stage is confined to the epithelial scales, as in body lesions. It is only after the scaly patch has reached the size of one third of an inch or so in diameter that the hair is invaded."

When planted in or on French proof agar the fungus in these hairs manifested great "growth energy." In

a petri dish specimen incubated at 30° C. each hair became the centre of a fine, whitish, furry looking growth by about the 3rd day. The mycelium was quite dry, and situated above the surface of the medium.

Microscopically - very long fine filaments were seen at the edge of the growth - No vesicular swellings - no chlamydospores - no aerial hyphae - no denticulations noticed.

Some hairs grown at room temperature, gave evidence of growth about the 5th day, when some long like spun glass filaments were noticed growing down into the medium.

A 16 days' culture at room temperature showed a flail like submerged mycelial filament bearing numerous pectinations on its convexity.

In the same specimen were other filaments with several branches growing from the convexity. One such had seven processes of different lengths.

In another filament which curved in its course, beginnings of branches were evident on one convexity, and further on, eight branches came off the other side, this having now become the convex one. I also saw the appearance described by Drs. Fox and Blaxall as the "vertebral column" - a filament apparently bearing branches all round it. Some sudden complex branchings of mycelium were also noticed on filaments which had pursued a parallel course for some distance, with very little branching. I did not notice any difference in the diameter of parent and daughter branches,

so they were probably not commencing aerial hyphae. There seemed to be such an obvious gradation from mere indications of outgrowth to similarly situated long branches, that the impression of "pectinations" gained from this specimen was that they were merely stages in the development of branches (hyphae), which is in accordance with the view of English observers, and not stable entities at all, as M. Sabouraud has thought.

This growth was all submerged. Perhaps the hair had been rather deeply planted - Ampullary swellings were noticed. No spores were observed.

XX

GEORGE SMITH. (Half brother to Baby Hartley)

Age 6.

Hair - straight - fair.

A long standing neglected case of scalp ringworm. There were four red scaly rings of considerable size, two entirely on the brow, and two partly in scalp, partly on brow, while there were numerous patches scattered through the scalp covered with thick white "asbestos like" scales, amongst which diseased brittle white hairs were evident.

The scalp under the scales was inflamed.

Microscopically - The hairs were typically affected by the Microsporon Audouini fungus. Mycelial filaments, segmented and unsegmented, running parallel with the axis of the hair could be seen in places where the spore sheath was absent.

CULTURE.

Hairs planted on French proof agar, and incubated at 30° C. were seen on the 10th day to be the centres of dry disc like growths, with no signs of powdering or fluffiness. The largest of these was less than 1 c.m. in diameter.

Microscopically, - the growth was seen to consist of young luxuriant, succulent looking mycelium with very few ampullary swellings.

Septae between the cells seemed closer together at the growing point. The mycelium showed here and

there, curious interlacings like tangled skeins.

One hair showed well little sprouts of mycelium all along its course, and issuing from one end.

The scales from the skin lesions were not examined, but with so much free Microsporon Audouini fungus near, it is highly probable that they were due to this fungus.

XXI

JOHN SMITH.

Age 5. Hair - light brown - straight.

Another very long-standing neglected case, the first noticed in this household.

There were numerous patches scattered through the scalp covered with thick greyish asbestos like scales, with diseased hairs intermingled.

The diseased areas were seen to be raised and red after shaving. At the margin of the scalp there was an area which suggested that the fungus could no longer thrive in the apparently exhausted soil. Here, there was an absence of the inflammatory reaction which characterised the invaded portions of scalp elsewhere, and only a few withered looking old ringworm stumps were present on a smooth partially bald surface.

The majority of the hairs were long, brittle and white.

Microscopically - Typically affected by Microsporon Audouini.

CULTURE:- After 10 days growth on French proof agar at a temperature of 30° C. each hair had become the centre of a circular disc like growth, the largest of which was less than 1 c. m. in diameter.

The growth was thicker just round the hair, outside this a partial clearing was visible , -

There was a slightly downy edge.

Microscopically - Numbers of mycelial filaments had regular ovoid bulgings at one end of many of the cells. 

Some granular colourless bodies seen, - not distinctly fusiform.

No Aaron's rods.

Here again one is confronted by the idiosyncrasy of the Microsporon Audouini fungus.

If delicacy of tissue constitutes an attraction to the fungus, why, when once it gained entrance to the baby's scalp did it make so little headway?

As before mentioned the fungus in this infant's hairs grew rapidly when inoculated on to suitable medium, so that one cannot suggest a debilitated fungus.

Again, one would have thought that the delicate tissues of an infant's scalp would have showed at least as much reaction to the presence of the fungus as the tissues of the older boys, but the invasion is submitted to with complacency, so to speak, while thick scales, and hyperaemic raised bases in the other scalps manifest the irritation produced.

Family Epidemic.

XXII

WALTER SALMON

Age 5. Hair - dark brown, straight, strong

There were small, raised, red, round, scaly areas on brow and neck.

There was also a patch of Ringworm on the border of scalp and brow - showing papular inflammation, and a few diseased hairs.

Microscope showed typical Microsporon Audouini infection of hairs. Scrapings from neck patch showed scattered lanugo hairs with a thick felting of mycelium, not only on the root, but continued up the shaft for some distance.

My ideas as to the possible luxuriance of the Microsporon fungus in skin lesions were much enlarged by studying this specimen. There were colonies of coral like Mycelium, the component filaments of which were inextricably intertwined, and there were filaments round one hair which exceeded in length any that I had previously seen in small spore specimens. I think, however, that the twig-like appearance of the Mycelium is quite distinct from the Endothrix appearances.

Brow patch.

The most striking feature of this specimen was the large number of lanugo hairs, almost all showing the attack of the fungus.

The fungus was arranged round the root end like a loosely woven conical basket, and the hair had the appearance of being lightly placed into this, as one could trace it through the mycelial network ~~as in scalp~~. One long hair had the fungus preying on it some distance from the follicle.

XXIII

EDITH SALMON

Age 2½ years. Hair fair, fine, slightly curly.

Had a patch of Ringworm on border of brow and scalp. This patch was said to have been inflamed and irritable at first. When I saw it, the Mother thought it was just scurf.

The hairs from the scalp were very fine and short, most of them being broken from the bulbs - and showing typical Microsporon infection.

One hair, about 2 m.m. long, showed bulb, neck, and a portion of shaft apparently healthy, with intact cuticle. It was denuded of cuticle and covered with spores at its fractured end.

A lanugo hair from a furfuration on face, had a network of mycelium round it consisting of short, highly refractile, branching twigs.

Dr. Aldersmith states that Ringworm is rarely found on the edge of the scalp.

XXXIV

LILY ROBBINS

Age 7. Hair - long, thick, coarse.

There was a large irregularly shaped area covered with thick ashy scales, and denuded of healthy hair. Numerous diseased hairs visible. The Mother said that the child had had it ever since she was a fortnight old, and she did not know that it was Ringworm.

In addition to the typical patch of small spored Ringworm, there were some small, scattered, scaly areas.

No Ringworm ever noticed on body.

No precautions had been taken; and the child attended school. There were three other children in the family, with whom the girl had slept and played, and shared the common toilet requisites.

HENRY ROBBINS

4 years. Hair - fair, coarse, straight, short. Scalp clear and healthy. One or two tiny scaly places found on close scrutiny, a few millimetres in diameter. No diseased hairs seen.

JOHN ROBBINS

Age 3. Hair - fair, coarse, straight, short. One or two very small superficially scaly areas seen. No diseased hairs found.

BABY ROBBINS

3 months old. Hair - fair and fine. Child with Ringworm had nursed this Baby, but its scalp was clear and healthy. No sign of disease.

Hairs from Lily Robbins examined - length 8 m.m. and less - twisted - angular - no bulbs - typical Microsporon Audouini appearances.

Microscopically - also typical Microsporon appearances. In one a long narrow, sheathless part was seen, between two diseased portions of hair, possibly indicating a double attack.

XXV

Family Epidemic.

NORMAN WARD.

Age 5 years. Hair - fair, straight.

Mrs. Ward sought advice for this child on account of a skin eruption of head, face and shoulders, accompanied by great irritability and restlessness.

When I first saw the child, the skin of the face showed scattered small papules, but no localised inflammation. There was a patch of superficial dermatitis on the back, between the shoulders, the nature of which it was difficult to determine, as the lesion had been scratched, and was crusted with sero purulent scabs, with an areola of scattered small papules. (One could not exclude ringworm from the naked eye diagnosis.) The scalp was hyperaemic, and presented several patches of unquestionable ringworm, covered with short, irregularly disposed, diseased hairs, but few or no scales.

In addition to these there was a round area, about 1 inch in diameter, of acute inflammation, exuding serum and pus, situated on the vertex. The hairs on this patch could be extracted with gentle traction, but they were not really loose, nor broken. There were scattered vesicles also on the scalp.

I do not remember any pediculous complication in this family.

There was a history of the father having contracted some form of dermatitis from a horse said to have the mange, and the youngest child had shown a skin eruption of similar nature a few weeks before I saw the above case. The horse had been shot, and the father and child had recovered so this matter could not be investigated. The baby boy, however, had a ring of tinea tonsurans on one temple, which could not be carefully examined as he would not sit still. He was 2 years old. Hair - fair, fine, slightly curly.

XXVI

A brother, Teddy Ward - age 8 years, showed a perfect ring about 1 inch in diameter, under his chin, pale in the centre, and with a raised and markedly vesicular edge which was covered with thick scabs.

He also had scalp ringworm, an irregularly shaped small patch, covered with short dull cotton like hairs, its base showing a goose flesh appearance but few or no scales.

XXVII

A sister, Elsie Ward - age 6 - hair fine, fair and long, had a similar area of scalp ringworm about 1 inch in diameter on the vertex. The scalp here showed no inflammatory reaction and little or no scaliness.

The appearance was of a small cropped patch amongst the long hair - the diseased hairs looking darker than the healthy hair, not at all hoary.

The eldest lad who slept and played with the others had apparently escaped infection. I could find no ringworm on his scalp. He was 10 years of age. With reference to the part taken by hair dressers in spreading ringworm, Mrs. Ward said she had directed the attention of the barber to a patch on Teddy's head, but he had remarked that it was only scurf, and his precautions anent his next customer would therefore doubtless be nil.

Mrs. Ward had herself had a small inflamed round irritable area under her chin, but this was now only faintly hyperaemic.

I thought it possible that a fungus other than the prevailing microsporon might be responsible for the inflammatory lesions in this epidemic, especially after hearing the history, but microscopic examination revealed only this form of fungus throughout.

The absence of marked scaliness was a noticeable feature of all the scalp lesions. The mother had applied vaseline to the places which she had noticed, but the little girl's scalp affection had been overlooked, and yet it resembled the others in this respect.

The brittle, frosted appearance of the hairs, seen in entirely untreated cases of Microsporon Audouini was also lacking.

The scalp hairs from all the cases showed Microsporon Audouini infection with somewhat badly marked spore sheath formation, and correspondingly well seen mycelial filaments.

The child for whom I was called in, had what looked like a commencing measles rash the next day, and his eyes were suffused, but the further confirmation of the measles diagnosis was not forthcoming.

There was little or no constitutional disturbance; the rash did not develop well, and none of the other children took measles. Considering, however, that measles was epidemic at the time, and that the eruptive stage is often characterised by great itchings of the skin, also that the eczematous complication was transitory, and had no other manifest cause, it is probable that the determination of blood to the skin, due to a mild attack of measles, with the already existing ringworm, and the scratching, were the factors which gave rise to somewhat puzzling appearances.

The impetiginous areas on the scalp and back soon disappeared with white precipitate ointment (diluted with Boric) applications.

No fungus could be found in the hairs or scales from the inflamed area on vertex, even though these became loose, and deviated a little from the aspect of the normal hair - looking somewhat twisted and

ruffled. One such showed a fringed appearance at its distal end, the bulb and shaft up to this point being normal. I have noticed this irregular fracture of a hair in another case where no ringworm could be found on the scalp, and am of opinion that its etiology is distinct from ringworm.

Scrapings from the lesions on Mrs. Ward's chin showed no fungus.

The crusts from the vesicular edge of the tinea circinata patch on Teddy Ward's chin showed the Microsporon Audouini fungus. There were many lanugo hairs, and these had their root ends ensheathed with mycelium which in this specimen was closely fitting, and thus simply exaggerated the normal outward curves of the papillary end of the hair, giving the combined hair and fungus the appearance of a cone with its apex at the distal end, as opposed to the cone produced by the loose network of mycelium seen in other microsporon specimens, which had its base towards the skin surface. When disintegrated by pressure, the sheath was seen to consist of innumerable pieces of fine twisting mycelium, and the hair itself seemed uninvolved.

There were also present small clumps of gnarled arborescent mycelium, and straggling irregularly shaped filaments not in relation to the hairs; no spores seen.

The only hairs planted from this group of cases were those from Teddy Ward's scalp lesion, on French proof agar, and incubated at 30° C. One could see after 10 days concentric rings of growth round one hair. The rings seemed formed by an attempt at the production of aerial hyphae, the intervening mycelium being almost devoid of above surface growth. The largest circle was a little over 1 c.m. in diameter. The border consisted of fine silky radiating filaments. I took impression preparations but could find no spores or indubitable "Aaron's rods."

I found one globular, granular, colourless body, attached to the end of filament. No chlamydospores.

XXVIII

FAMILY EPIDEMIC

MINNIE DAWSON

Age 8. Hair - straight, long, light brown. There was a patch of Ringworm, which had been treated, on the vertex, not definitely circular, crusted over with yellowish, dirty coloured, scabs. When the crusts and intermingled long loose diseased hairs were removed, the base was seen to be slightly raised, inflamed and boggy, with gaping follicles. It was not subjectively "sore". Not at all like Kerion.

Microscopically. Many of the hairs extracted were complete. They were typically affected with Microsporon Audouini fungus. No mycelial fringes were discovered.

One hair showed apparently intact cuticle on the neck, and yet filaments of segmented mycelium issued from the follicular end, showing its intra pilar position, and also the possibility of confusion with endothrix if only a small portion of a hair is examined.

In another hair, fine mycelial threads were noticed traversing the hair transversely. The marked preservation of the bulb, and of the hair for a little distance above this, was noticed in one hair.

Hairs planted on French proof agar and incubated at a variable temperature, showed no signs of growth after a week. The hairs which had been

planted and proved sterile were examined; - spores were seen, but none were sprouting.

It is interesting to consider whether the absence of mycelial fringes and the sterility of the fungus when planted, bear any relation to the clinical fact that the case completely recovered in a month or two from this time without severe treatment.

The Mother had poulticed it because is was "sore", but the treatment in use was not enough to account for any marked inflammatory reaction.

The next time I examined the head, I found a clean dry hyperaemic surface with no trace of disease.

The sterility may of course have been due to parasiticide treatment when in the scalp, but I have often successfully grown hairs from treated cases.

XXIX

HERBERT DAWSON

Age 8. Hair - straight. Treated.

When first seen only one patch was noticed on the scalp. The hairs on it were long, whitish, and somewhat loose.

Microscopically. Typical microsporon infection observed. Smallspores, arranged in "rows" and groups, seen on the bulb; and well marked mycelial fringes at the junction of the shaft with the neck of the hair - good mosaic spore sheaths.

The Mother had noticed this patch for a considerable time, and it seemed stationary in size, while the fungus was making rapid strides in the scalp of a younger sister.

Since that time, however, the boy has had several patches on the scalp, and some body lesions, now to be described.

The rapid spreading in the boy has been coincident with the warmer weather, but the same cannot be said of the vigorous growth in the younger sister which occurred at an earlier date.

There was a well marked patch of tinea circinata on the left thigh near the groin. It consisted of 2 circles. The outer circle was about the size of a 5/- piece, and had an inner faded scaly portion, and an outer raised red edge. Within this was an imperfect circinate figure, with a raised red

papular edge .

Microscopically. Numerous short thick unsegmented branching pieces of mycelium seen. No lanugo hairs; no long luxuriant filaments seen; no spores.

Scrapings from a circular patch on the arm, the size of a big pea, showed very luxuriant mycelium, but it was characteristically twisted and branching. No lanugo hairs seen.

Scrapings from pin head furfurations at nape of neck also showed abundant curly mycelium, ramifying as a thick network, through the shadowy squames.

XXX

GEORGE ROBERT DAWSON

Age 2. Hair - fair, straight.

When seen, child had a round patch of Ringworm about the size of a 5/- piece on fronto parietal region. His Mother said he had at first a patch of Ringworm on the face, then one on the border of hair, and still later, the one described entirely on scalp. It had been treated - no scaliness evident - Hairs 1 - 1½ c.m. long. The patch was covered with long, dull, diseased hairs. Some at the margin were extracted complete.

In the hairs where the bulb had been extracted entire, a few square spores with a linear arrangement were always seen on the bulb.

Many hairs broken just below the fringe; showed the mycelial filaments composing it, issuing from the fractured end. One could trace the mycelial filaments of the fringe under cover of the spores, some way up the shaft.

XXXI

95

EDITH DAWSON

Age 4. Hair - straight, fair.

This child had long hair, which the Mother was loath to clip off. The fungus had attacked the greater part of the scalp when I saw it. The Mother had noticed the hair being bitten off at the roots in rings, and coming out when combed. She thought three patches developed in one week.

Large round areas coalescing, and leaving hardly any healthy scalp between them, occupy the crown of the head. The twisted, tangled looking diseased hairs come out painlessly in bunches.

A few carefully extracted ones showed mycelial fringes but most were broken off above these.

The infection was typically that of Microsporon.

A fading sharply circumscribed patch about the size of a penny was seen on the back, which according to the history had been vesicular. No fungus was found in scrapings from this.

Tiny scaly patches, reddish yellow in colour, were present on chest, neck and under chin.

Scrapings from the lesion on chest, showed luxuriant arborescent unsegmented mycelium. There were some unusually long unsegmented filaments for this type of fungus but characteristic curly pieces were also seen. No lanugo hairs were visible.

XXXII

MRS. DAWSON

Three hyperaemic scaly areas on the neck had been noticed, which she had treated with children's ringworm ointment.

These had faded, when I saw them, but a scraping showed one lanugo hair and a portion of another.

This hair showed a somewhat faintly refractile, large, irregularly jointed mycelium in it at one end, and there was a mosaic of small spores round the other end. Between the two extremities, it had a comparatively healthy appearance.

There were also some groups of small round spores, scattered about the field, and a few pieces of highly refractile unsegmented mycelium.

This hair was so small that I required the aid of a lens to see it clearly when on the slide.

(I mention this as it reassured me that I was not dealing with a child's scalp hair.)

FAMILY EPIDEMIC

Notes on 5 cases of Ringworm in one family; the fungus in each case being the Microsporon Audouinii.

XXXIII

FRANK HOLT

Age 3. Hair, fair.

Chronic diffuse Ringworm, involving the greater part of the scalp. The Mother said disease had spread when child had chickenpox. Affected areas covered with thick asbestos like scales and short white hairs, on an inflamed base.

Some furfurations were present on neck, just at the junction with the hairy scalp.

Exam of hairs. Some are long, brittle and white. Microscopically - Typical Microsporon Audouinii infection seen - mosaic of small round spores. Incomplete fractures of hair noticed in one instance, a few central strands keeping fragments together. Mycelium of hair seen as thick, comparatively short, unsegmented pieces.

Culture. Hairs planted on French proof agar, and incubated at a temperature of 30° C. for 15 days. At the end of this time a fine halo of fungus growth was visible round some of the hairs - growth looks all submerged. No indication of powdering.

There is a deep brown pigment round the hairs. Microscopical Examination showed long succulent threads of mycelium with luxuriant branches - contrasting well with the universal granularity seen in old specimens. A few ampullary swellings visible. One filament had four swellings all together at the terminal end. Numbers of roughly ovoid granular bodies scattered about the specimen. Some of these appear attached to the ends of filaments, others are free. Are they Chlamydospores?

XXXIV

DORIS HOLT

Age 2. Hair, fair, fine.

One or two tiny superficial furfurations discovered, which hid one or two diseased hairs.

The hairs and scales from this scalp, when examined microscopically also showed the Microsporon Audouinii fungus. The mycelium could be well seen even with the low power amongst the scales as an abundant thallus of the Microsporon Audouinii type - twisting - anastomosing - gnarled looking, with short branches some of which had bright refractile spots of protoplasm at their extremities, possibly indicative of spore formation. In some places the mycelium was less curly - no segmentation seen. One hair was attacked after the manner of a lanugo hair. This was long and very fair and fine. The mycelial

covering of the root end formed like a loosely woven conical basket, had been pushed to one side by the pressure of the coverslip, leaving the bulb and shaft apparently intact. There were no spores present round the root end. Some more filamentous mycelium was lying over or round the shaft.

Another hair showed the method of attack commonly seen in scalp hairs. It had a long, thick, close-fitting sheath of small round spores, and the rest of the shaft was denuded of cuticle. When this was crushed by the overslip, the disintegrated hair disposed itself as a loose meshwork of hair fibrils, in the interstices of which small round spores could be seen.

I have not, unfortunately, noted the exact locality of these furfurations but the presumption is that they were on the scalp as I have not noted otherwise. It is noteworthy that this initial lesion showed much the same appearance as a scraping from a body lesion, and as the furfurations were more obvious than the diseased hairs, the case might be adduced to prove the primary affection of the epidermis in Microsporon Audouinii infection, which is insisted upon by English observers in contradiction to M. Sabouraud's view of a secondary epidermis affection - Microsporon.

XXXV

EDITH HOLT Age 13 9/12.

Hair - long, thick, fair.

Scalp showed on close search several scattered small insignificant patches with slight or no scaliness, each containing a few very short hoary diseased hairs. These hairs were disintegrated - only 1 - 2 m.m. in length.

Microscopically: some large mycelium was noticed just at the beginning of the formation of the mosaic spore sheath - no bulbs - nothing else unusual. This case probably instances the gradual decline of the disease at puberty.

XXXVI

NORA HOLT Age 6.

Hair - long, red, coarse.

First case noticed by the Mother.

Scalp showed a large diffuse dry scaly area of Ringworm in fronto parietal region.

Diseased hairs were short, and microscopically were found to be affected by the Microsporon Audouinii fungus. Many of the hairs in this case seemed to show that the fungus had attacked them from two points as a comparatively healthy sheathless portion occupied a position between two thoroughly diseased extremities. On this intervening portion, one could see mycelial filaments, some long, broad, straight and unsegmented, leading up to and merging

in the spore sheath. This appearance may have been caused by the "Ghost Mycelium" of Adamson forming the spore sheath.

XXXVII

MABEL HOLT 9 years.

Hair red.

There were a few scattered, insignificant places, slightly scaly, in which a few diseased hairs were found with difficulty. The hairs were disintegrated, white, and attacked typically by the Microsporon Audouinii fungus. Nothing unusual noticed.

None of the hairs from these four cases were grown on medium.

In considering the subject of family epidemics one naturally faces the question, why, with an equal exposure to the same fungus, do some members of a family give it quarter and nourish it, while others successfully resist its attacks.

Dr. Leslie Roberts says "One individual (fungus) may differ from another physiologically, without much or any alteration of form."

"Thus to cite once more the case of the two sisters suffering from Ringworm.

Cultivation of the two individual fungi in a common soil manifested no noteworthy differences,

and yet the virulence of the fungus in the elder sister was considerably higher than in the younger sister.

The history of the case leaves no room for doubt that the disease was acquired from the same source."

(Page 61. "Fungi parasitic on Man").

He seems here to magnify the importance of one factor and ignore the existence of the equally potent factor of nature of soil.

His inference from the case is that the virulence of the one fungus was considerably higher than that of the other. Might not the following inference be as true?

The soil provided for the fungus by the tissues of the elder sister proved to be much more conducive to its growth than that provided by the tissues of the younger sister. It may have required a greater "growth energy" to have continued a bare existence on the uncongenial soil of the younger sister's scalp, than it neededto exercise in thriving on the congenial soil of the elder.

I have planted diseased hairs from the same case on media of different moisture, and have found those planted on dry maltose agar prove sterile while those on the moist agar grew well.

Again I have seen a series of tubes of French proof

agar which had been prepared with a very slight difference in their acidity, and had had portions of diseased hairs from the same case planted on them, with the result that those on the least acid medium grew best, those in the most acid proved sterile, and the intermediate tubes showed intermediate results. (Dr. Arthur Hall's experiment).

After all, very little indeed is known concerning the factors which determine immunity and susceptibility to the invasion of the fungus.

Leslie Roberts says that man in his childhood is the favourite host of the fungus because of the "unctuous condition of his skin, and the delicacy of his structures."

I have seen Ringworm in Ichthyosis (without moist catarrh) and in children with coarse strong hair.

The colour of the hair has no perceptive influence.

The most rapid onset I have witnessed was in a child with very dark, coarse, hair and my Ringworm cases have had hair of all shades.

I do not remember noticing Ringworm in any really curly-haired child, but this may be coincidence. I have had two cases of Ringworm in babies under a year. One Microsporon - one Megalosporon, but their delicate tissues have not shown any vigor-

-ous reaction to the fungus.

In this family no precautions had been taken against spread. The children mixed with others, and those of school age attended school.

The affection as existing in its milder forms was regarded with complacency, and practically or entirely untreated, and it was only when the one boy of the family was much disfigured by very extensive loss of hair and accumulation of thick ashy scales on his scalp that medical aid was sought.

The youngest child had been very delicate from birth, but at the time of observation, the scalp affection was most insignificant.

The boy mentioned was a sturdy, rosy-cheeked, child, and yet in him the parasite had found a most enduring host.

There had never been any body Ringworm noticed in this family

Given a family of children differing in robustness, and complexion, into which Ringworm has been introduced, it would be quite impossible to foretell which child would resist the attack of the fungus, and which would afford it a favourable nidus.

To quote again from Leslie Roberts.
"Soils would appear to have their affinities for particular spores just as chemical elements have

affinities and disaffinities towards other chemical elements, and probably at bottom, although unknown to us, those affinities between soil and organism are as precise as the atomic theory, or law of gravitation, and may possibly in the future be grouped under some law of vegetal affinities." And again, speaking of the "inter reactions of soil and organism" being "prepotent in producing variations" "For were we able to follow these inter reactions right down to the essential chemical changes in parasite and host, we should have no difficulty in understanding immunity, and the origin of races."

Until the law of "vegetal affinities" is discovered the problem of the influences at work in the production of immunity and susceptibility will await solution.

XXXVIII

JESSIE GOODACRE.

Aged 4. Hair - straight, fair.

There was one large round sharply circumscribed patch of ringworm covered with thick ashy scales and diseased stumps.

There was hardly any healthy hair on this area. The base was inflamed, under the scales.

There was a similar patch, less advanced, on the nape of the neck.

Microscopically - Hairs were affected typically with Microsporon Audouini fungus.

Child's brother, a young man, reported to have a ringworm on his wrist - not seen by me.

This child played with other children, without restrictions, so far as I know.

XXXIX

BEATRICE WEBSTER.

Aged 4. Hair - straight, dark.

This scalp showed chronic ringworm of long standing. Hair thinned all over, very thin on the vertex, which was covered with thick asbestos like scales and brittle, twisted, broken, ringworm hairs.

The microscope showed typical Microsporon Audouini infection. Length of diseased hairs, ½ c.m. and less.

This case was so obvious to the informed eye, that it could be diagnosed on the street, yet the mother thought the ringworm was cured. The child went regularly to school, played with other children without restrictions, shared the family toilet requisites and slept with two sisters, aged respectively 9 and 15 years, and there had been no known extension of the disease.

This case illustrates as well as any the state of matters which is thought desirable by Dr. Goodhart.

In Mr. Malcolm Morris's book on Ringworm, p.95, the following quotation is given.

"With some trepidation, too, I am inclined to say that a very different disease is made more of than its importance deserves, and that is ringworm. I never now attempt to treat it, I send it on to the dermatologist. I cannot cure it, and very often he

cannot. And sooner or later it is taken out of his hands, and either left alone, or treated with ink or Condy's fluid by the herbalist, who then, having made to himself friends of the mammon of unrighteousness, as far as he deems judicious, calls it cured, and thenceforth the child is let loose again upon society.

I often wonder when I hear of a child with ringworm of a year's or perhaps two years' standing, and, of course, kept out of school and away from his companions all that time, what would have happened to his associates equivalent to the harm that has accrued to the child and his attendants from the treatment that he has undergone.

Honestly, I should very much like to see the parable of the tares and the wheat applied to this disease under scientific observation.

To start with, no doubt the sheep and the goats - I mean myself and the dermatologist; no, I beg pardon, the dermatologist and I - should differ as to the prospects of the harvest, I not expecting in the end to have much of the tares to deal with, he not much of a field of wheat.

Anyhow, I am quite sure of this, that we should hear much less about ringworm - whether for the good or evil of the community, I will not attempt to decide, if mothers had not got it into their heads,

quite erroneously that it is a dirty disease." ("Some of the Limitations of Medicine" reprinted from Lancet, Nov. 2nd.1895).

My experience of Ringworm, amongst the poorer classes in Worksop, has illustrated this state of affairs admirably. The parable of the wheat and the tares is being played out, but unfortunately not under scientific observation.

I have been forced to the conclusion that the result will be the perpetuation of ringworm to future generations for a long time to come, unless the governing bodies of the schools for poor children take exceedingly stringent measures, measures indeed, which would seem to most people to be entirely out of proportion to the harm done by ringworm.

In a family where the provision of sufficient food and raiment is a matter of difficulty one cannot wonder that "a scurfy head" is lightly regarded.

It is true that the majority of ringworm cases left untreated would cause no permanent harm to the children if the aesthetic aspect were disregarded, but, to persuade a sensitive parent to regard complacently the possible transformation (and no one can foretell how far the ringworm will go) of a child's hairy scalp, naturally a crown of beauty, into something very much the reverse, is no easy task, and so long as the aesthetic portion of the community retains its view

of the question, so long will ringworm be regarded with the utmost abhorrence by that section of society, and the victims of it suffer the inevitable shunning, the consequences of which to temperament are incalculable.

XL

FRANK FULLER.

Age 6. Hair: straight - red.

There was one large circinate area, about 2 inches in diameter, on which healthy and diseased hairs were growing, the former hiding the latter.

The diseased hairs were swollen, and of a deeper colour than the normal hair. The case had been Clinically. treated. It seemed to benefit little by the rubbing in of ointments.

Croton oil treatment, followed by poulticing, and when the hairs were loosened epilation, cleared the patch by degrees. When the diseased hairs had been removed in this way, chrysarobin ointment was rubbed in and it seemed to keep the patch clear.

Microscopically. The hairs were affected by the Microsporon Andouinii fungus.

CULTURE. After a month's growth on French proof agar at a temperature varying from 22° C. to that of the room, a tiny submerged circular growth was discerned at one end of a hair, barely 3 millimetres long.

The sterility of part of the hair was possibly due to parasiticide applications when in the scalp, as has been shown by Dr. G. Thin.

Microscopically - a dense network of mycelial threads were seen round the hair, and long homogeneous unbranched filaments at the periphery of the

growth. There were many symmetrical swellings of the mycelium, some terminal, some in the course of filaments. The protoplasm of these was variously arranged, sometimes as refractile granules, sometimes in what looked more like vacuoles. No aerial hyphae formed. No fusiform bodies noted.

Perhaps it is worth mentioning in reference to the discussion as to the possible connection between Alopecia areata and ringworm, that in this case, I found a small patch less than a 3d. piece, in an unaffected part of the scalp where the hairs were short and dead looking, and could be picked off the affected area, which when cleared was quite flat and smooth and uninflamed, showing no trace of stumps.

Microscopically - none of the hairs showed any trace of fungus and the patch gave no further trouble.

XLI

BERTIE MAINE.

Age 5 (?) looks less.

A case of old standing disseminated Microsporon infection.

Clinically - Croton oil treatment most helpful of any used, followed up with inunction of Oleate of Mercury and Chrysarobin ointments.

Culture - Hairs planted on French proof agar and incubated at 22° C. and below this showed after about 13 days a round closely knit fluffy growth, cream coloured in centre, whiter at the edge, about ½ inch in diameter.

Indications of furrows could be seen radiating from the centre.

A week later, its diameter was 2 centimetres and 5 sulci could be plainly discerned, two deep, the others shallow. These could be seen as ridges from the under surface. A pale buffy pink, colour tinted the aerial down.

Microscopical examination of the aerial hyphae showed a form of fructification I had not seen before, either in ringworm, or any of the common moulds.

It consisted of a terminal expansion of the aerial filament with little buds projecting all round it. The specimen latterly was contaminated, but I think what I have just described was one of the "sports" or 'commensals' that are known to exist, as

the downy surface was peculiar when the culture was to all appearance a pure one.

XLII

SAM SMART.

Age 9. Hair - straight, coarse, brown.

I treated this scalp for seborrhoea for some time before I detected ringworm stumps amongst the scales.

When examined these showed microsporon infection.

XLIII

HERBERT ROBINSON.

Age 9. Hair - straight, fair, ~~xxxxxxx~~

An insidious case of slight microsporon infection. Atrophied hairs seen in this scalp similar to those described elsewhere.

XLIV

FRED WALLBANK.

Aged 6 years. Hair - dark, straight, strong.

In this case there were no definite patches of disease, but after shaving one could see isolated, raised follicles, and if the hair was allowed to grow, one found here and there a few more or less diseased hairs which were long (1 centimetre) and thin, some of them stretching in the follicle before breaking; in a somewhat unusual way.

Microscopically - A thick sheath of small spores was seen round a hair in part of its course.

Long unsegmented threads of mycelium were seen inside the hair (after staining) and there were some strings of spores noticed which I have noted as "not like T. endothrix spores, being round and smaller."

This was apparently a case of disseminated Microsporon.

XLV

EMMA WATKINSON

Age 8. Hair - fair, straight.

This child had a round patch on the scalp about 1½ in. diameter, thickly covered with grey asbestos like scales, and long - brittle white hairs. Denuded of healthy hair.

Microscopically, - hairs showed typical Microsporon Audouini infection.

In one, where the spore sheath was absent, long unsegmented and segmented mycelial filaments were seen running parallel with the axis of the hair. In proximity to these, were groups of spores of irregular shape and size, but definitely larger than the usual small round spores. These spores and filaments merged into the spore sheath.

I presume that this phenomenon illustrated a stage in the formation of the spore sheath. The elements were not "ghost like" however, but brightly refractile. In places, the regular segmentation resembled that typical in Endothrix Mycelium.

A ten days culture on French proof agar, at a temperature of 30° C., showed a flat, cream coloured, faintly downy, circular growth round each hair, less than 1 c.m. in diameter.

Microscopical examination showed a granular Mycelium - no unusual appearances - no chlamydospores.

NORMAN WYNN.

A delicate backward child. Hair; fair, straight. Said to be five years old - looked like three years.

He had scalp ringworm produced by the Megalosporon endothrix, and that by the Microsporon Audouinii during the same year.

In my first notes of his case I have made a diagram of one of his hairs, a typical megalosporon endothrix, and have used it for purposes of contrast with a hair from another child affected by microsporon audouinii, pointing out that the hairs from Norman Wynn's patch -

(1) Showed no thick furry sheath.

(2) Had a better preserved outline.

(3) Showed chains of spores (segmented mycelium), and

(4) Long branching threads of mycelium in which the spore formation was less clearly seen.

(5) Showed the imbricating scales of the cuticle outside the hair.

As regards the clinical appearances, I have described it as a case with tiny ill-defined patches, slightly raised, pink and boggy, with follicles apparent, after the scales had been cleared away; and have noted that when left without treatment for a

fortnight, because it looked quite well, numerous small powdery greyish white scales formed on the patches.

Some months later the child meanwhile having been discharged as cured, a small round patch of ringworm, size between 6d. and 1/-, was found on the vertex, covered with thick, greasy looking greyish yellow scales. Some long hairs were growing on this patch, and a few short diseased hairs were visible amongst the scales. The rest of the scalp appeared perfectly clear.

The diseased hairs from this patch were found to be typically affected with the Microsporon Audouinii fungus.

NOTE: - "Typical furry hairs with mosaic of small round highly refractile spores.

No culture was grown from the hairs found in the earlier form of ringworm from which the child suffered, but hairs from the scalp lesion latterly found, were planted on maltose agar, and incubated at a temperature of 30° C. for 16 days.

At the end of this time, small discs of fungus growth less than 1 c.m. in diameter were seen on the surface of the medium, somewhat moist looking, having no visible aerial hyphae.

Microscopic examination showed many symmetrical ampullary swellings on the mycelium, some of which had granular contents. There were also a

few colourless finely granular bodies scattered through the mycelium, generally without apparent attachment which looked a little like further developments of the ampullary swellings. Unless these were chlamydospores none were present.

No spores were seen.

The clinical course of the Microsporon Audouinii patch was satisfactory.

The patch and a ring of hairs round it was epilated. It was treated with croton oil and poulticed. Glycerine and formalin were rubbed into the surrounding hair as a prophylactic;-

It showed no tendency to spread, and I have noted that after about three weeks the patch was healing over and there was no appearance of extension.

I have not noticed a case similar to this in the literature at my command.

Mr. Malcolm Morris mentions a case where two lesions, one on the scalp, and one on the neck of the same child showed the small spore and large spore fungus respectively, present.

Dr. Aldersmith says that since Sabouraud's discovery of the plurality of the fungi causing ringworm was published, he has not found two forms of Tinea on the same scalp (P.30 Ringworm and Alopecia Areata).

Probably he meant that he had not discovered the two fungi contemporaneously.

Such a case may, however, be merely a question of susceptibility and exposure to both kinds of ringworm infection, and does not, when so exceptionally met with, weaken the accepted doctrine of plurality any more than the case of a child suffering from one infectious disease, and at the same time, or shortly after, contracting another, weakens the belief that the two infections have separate entities.

XLVII

MARY ANN DAY.

Age about 5 years. Hair - straight, brown.

A delicate anaemic child. Scalp showed extensive tracts of dull hair, which when touched with chloroform were whitened.

There was no scaliness or evidence of inflammation when I first saw it, but I think it had been treated.

No treatment had any apparent curative effect until croton oil was used. The loosened hairs were epilated and the patches very considerably cleared. The child was then boarded out, and so lost sight of.

The hairs showed typical microsporon infection.

XLVIII

ANNIE DOWNES.

Age about 6.

Another exceedingly obstinate case of microsporon infection. Hairs showed sheaths of small round spores. There were three main round patches which did not extend their borders appreciably for many months. The scalp was very readily inflamed, e. g., inunction of chrysarobin ointment which (the same strength) could be used for weeks, - only causing deep purplish staining and fine desquamation, - on some scalps, would raise superficial vesicles in

two days on this. After yielding to such an extent that I had to search for diseased hairs, it relapsed badly again though under treatment all the time. At times I used croton oil, but I could not cure it. I perhaps did not continue its use over a long enough time.

This child's younger brother was admitted with her. I cannot remember whether he had ringworm on admission or not. I once found the endothrix fungus in one of his hairs. I think that I also found the microsporon at another time, but I have no date for this now. His case was a very insidious one. Often I could only find the short black tipped atrophied hairs described elsewhere, which contained no spores, but which I always regarded with suspicion though perhaps I need not have done so.

XLIX

REGINALD SMOOTHEY.

Age 6 years.

Reported as having ringworm 4 years ago.

Hair showed sheaths of small round spores -

Some long filaments with irregular segmentation seen streaming from end of a hair, apparently of intra pilar origin.

Another extremely obstinate case of Microsporon infection.

V

CHRISTOPHER MURPHY.

Age about 5 years.

A case of Microsporon infection of the scalp after the disease had yielded to treatment elsewhere; its almost incredible obstinacy was well shown in one patch less than a 3d. piece which persisted for over six weeks in spite of croton oil, formaline and ointments, vigorously used.

CULTURE:-

A hair planted on potato and incubated at 22° C. and below this showed after 5 weeks, a roughly circular, white downy growth about ½ centimetre in diameter - margin of the growth is buff coloured and less downy. The growth was very slow in appearing. It was pure. A round brown stain was left on the potato after growth removed.

Microscopically - No typical 'Aaron's rod' formation seen. - Round refractile bodies seen in the mycelial meshwork but not apparently attached to it.

No chlamydospores recognised as such.

LI

ARTHUR BAILEY.

Age, 4 years.

Another case in which atrophied hairs abounded. This also was a very insidious case with very few bad hairs. My notes at one time speak of an indistinct furry outline, a lost cuticle, and the presence of small spores in groups and masses.

Some time after his discharge as cured,
At another, of a small slightly scaly ring with a red base, overgrown by long hairs one of which (about i inch in length) contained a few chains of spores at the follicular end. After having given Norman Wynn's case, where there was no dubiety about the occurrence, at different times, of the two varieties of ringworm. I have more confidence in mentioning
(J. Dowd & A. Bale,)
these in which the evidence is somewhat scanty.

L 11

WILLIAM RICHARDSON

Age 3-4.

No scalp Ringworm discovered.

There was an almost perfect ring, about 1¼ inches in diameter, on the brow. It had been treated with ink, and with the exception of a few pin points of redness, the lesion had a faded look.

There were no distinct vesicles, but for a considerable part of the circumference, the epidermis, which had been raised by exudation, could be lifted off with fine forceps. The surface thus bared was pink, and slightly moist. The knees showed deeply scabbed areas, but the bases of these had more induration than is seen in tinea circinata. The source of infection was not discovered.

A neighbour's child had some fading patches of dermatitis which had been treated with ink, but scrapings from these gave a negative result.

A dog in the near neighbourhood had areas of partial and complete alopecia. Loose hairs from these, however, showed no fungus.

The epidermic scales from the ringed brow lesion, were found to contain abundant mycelium of the Microsporon Audouini type - curly, arborescent, and irregularly shaped, with more highly refractile points of protoplasm dotted here and there, perhaps indicative of spore formation.

The lanugo hairs, however, formed the chief centres of attraction for the fungus. In this specimen they were numerous, and were ensheathed in fungus and follicular cells.

The Mycelium was disposed like a cone of loosely woven basket-work around each root end, the apex corresponding to the deepest part of the follicle. In some cases it extended up ~~to~~ the shaft, but no mosaic spore sheaths were present, as in affected scalp hairs, and the encircling mycelium could be pressed away from the hairs, leaving them apparently entire.

No culture was made from the scales, but the microscopic characters were quite distinctive, proving that the small spored fungus can give rise to well marked circinate lesions.

L111

Miss M. Age 40.

This case was interesting as it seemed to illustrate somewhat strikingly the immunity of the adult scalp to Ringworm.

When first seen there were two circinate patches on one shoulder, the larger about the size of a 5/- piece, the smaller a little larger than a shilling. They had partly coalesced and were raised and faintly scaly. The patient complained of the patches being very itchy. In addition to these, there were two raised, red rings in amongst the hair, on the nape of the neck. These also caused much irritation.

I painted the shoulder with Liquor Iodi. fort. and ordered unguent hydrarg. ammon. to be used for the patches in the hair.

In a few days the patch on the shoulder had almost disappeared, only a small raised area remaining. The rings in the hair were still present, and the rubbing to ease the itchiness had produced erythema all round.

I then painted the scalp over these rings with Liquor. Iodi. fort., also the remaining raised area on shoulder. In about a fortnight I examined the case again, and was pleased to find that they had entirely disappeared, and the hairs had not

become at all involved. I examined the scales but did not find the fungus. From its appearance, and response to antiparasitic treatment, I do not think its nature can be doubted, but whether it was due to the Microsporon or Megalosporon fungus remains unsolved.

I have little doubt that had such marked tinea circinata invaded a child's scalp, the result would have been much less satisfactory. (Vide Ralph Grabham's case.)

Months after observing this case I read in Dr. Aldersmith's "Ringworm & Alopecia Areata" (pg. 121) the following, under the heading of Megalosporon ectothrix. "I once saw a gentleman, who had returned from India, with very many large rings, running one into the other, all about the upper part of the chest and neck, and passing upwards on to the scalp. Yet none of the hairs were infected."

Although this lady might have been exposed to infection from children suffering with either the Megalosporon or the Microsporon form of scalp Ringworm, I can only remember one case which was suggestive of ectothrix infection and it started some three months previously.

Tinea circinata was not often seen in the institution, probably because the fungus was confined to the scalp by ointments, caps, or other

preventive measures.

LIV

A child, Albert Franklin, aged 6, with no known scalp affection, showed a peculiarly obstinate spreading dermatitis in the flexure of one knee.

The affection when first noticed consisted of numerous tiny pustules situated on an inflamed area of skin. The edge, which was raised, afterwards took a circular form, and spread, with vesicles.

The B.P. Unguent Hydrarg. Ammon. was at first used, but as this increased the inflammation, it was diluted with some weak zinc oxide paste and carron oil. I should think the circinate lesion occupied an area of at least 3 inches in diameter before the edge ceased to extend, and the bases of the pustules were somewhat indurated. In response to treatment the hyperaemia diminished, the edge became less raised, and desquamation began. I applied pieces of Elma's Mercury and Carbolic plaster over the obstinate pustules and the rest was dabbed with diluted liquor Carbonis Detergens. I think Tinct. Iodi. was more effective than anything else however. Quite a month elapsed before the skin became normal.

I did not examine the scales from the lesion, but its clinical appearance, course, and duration, leave little doubt that it was caused by one of the Ringworm fungi.

No other at all significant case of tinea circinata developed about the same time

I remember isolating a little girl who had no scalp Ringworm, but who showed a circinate spreading Erythema on the trunk. I never felt convinced that it was Ringworm, as it seemed to come and go somewhat independently of treatment, but the resemblance to tinea circinata was marked. After painting with iodine, the raised edge took on an almost erysipelatous appearance, which soon yielded to soothing treatment.

I think now that the case was one of the puzzling forms of Erythema circinatum annulare described by Aldersmith in his chapter on diagnosis.

Present day knowledge of contagious diseases brings with it a present day sense of responsibility, and Medical Officers of Institutions where children are gathered together, may regard with some degree of envy, the disinterested composure with which Erasmus Wilson viewed the occurrence of epidemic ringworm in such an Institution.

He says, "The breaking out of a disease in a "number of children, breathing the same air, partak- "ing of the same food, and living under the same "hygienic influences, is a circumstance of daily "occurrence, and one totally distince from conta- "gion."

There is something refreshing in the dogmatism which can ingeniously explain away as "Granular degeneration" the vegetable growths demonstrated in the hairs of favus and ringworm by his contemporaries, and can even illustrate his theory of their production from leucocytes.

At the same time his egotism must have been hard to bear by patient investigators, perhaps of less renown, whose views he criticised as "highly unphilisophical" and "indeed unwarranted by a more correct comprehension of the nature of these bodies" (spores).

He lays great stress on the "sub epidermal" position of favous matter, and infers that it would

be necessary to admit the production of a vegetable organism within animal tissues, before the parasitic view could be received as possible.

One is surprised to find after such expressions of opinion, that he was in favour of isolation in School Sanatoria at the sea side, of ringworm cases, on grounds of improvement of the general health which alone he held to be at fault. ("On Ringworm its Causes, Pathology and Treatment,"1847, by Erasmus Wilson, F.R.S.)

Amongst those who shared his adverse criticisms was Samuel Plumbe M.R.C.S. who wrote "An Essay on Ringworm of the Scalp, Scalled head, and other Forms of Porrigo" in 1827, which appeared to me as one of the oases in the desert of ancient ringworm literature.

He makes definite progress in abolishing the varieties classified by form, colour, and consistence of secretion, and resolving the disease into the circumscribed and diffuse forms, which although usually distinct, he states can pass into one another.

He also affirms that the body and scalp lesions are identical in origin and that their different duration is due to the hairs of the scalp acting as foreign bodies, and keeping up the irritation of the skin which he regards as the seat of the disease.

He notices that where the hairs go completely, the disease does the same, and that where the hair remains, pustules form, and concludes practically that to allow the skin inflammation to get well, it is advantageous to remove the hair daily from diseased parts. He explains the effects of pitch cap treatment by saying that it only removes the hair, and that the direct result of its removal is the subsidence of the inflammation, and the disappearance of pustules. Is he not a forerunner of Aldersmith?

The treatment of ringworm, although a subject of far greater importance to the happiness of the community than a knowledge of its mycology, is unfortunately, in a much less brilliant state of elucidation, and there seems to be such an incalculable element in the behaviour of the fungus that of 2 cases one treated by an ignorant layman, the other by a learned dermatologist, it is quite conceivable that the layman's result might be to all appearances more glorious, simply because in some unknown way the cases would not be parallels.

As an instance of this, I may mention one of my few pleasant surprises in the treatment of ringworm.

It was the case of Frank Holt (described under Family Epidemics).

The child, aged 3 years, was brought with a

scalp showing very extensive Microsporon Audouini infection, accompanied by marked parasitic pityriasis and great loss of hair. In the circumstances I thought that white precipitate ointment would do as well as any and gave this but with it, a somewhat gloomy prognosis as to the probable duration of the case.

Within a month of the use of this ointment, twice daily by the Mother, the most remarkable clearance had taken place. Although advised to sacrifice the remaining locks of healthy hair, this had not been done, and the appearance now presented by the scalp was somewhat like that of extensive Alopecia Areata, but with healthy, pink, smooth, hopeful looking, surfaces instead of white polished areas. I could detect no sign of stumps in several of these. Some typical stumps were still present in a few places.

To the lay mind, the banishment of parasitic scaliness is practically the same as the extermination of the fungus and this, of course, in many cases is accomplished long before the disease has really yielded but generally returns with the discontinuance of the parasitic remedy.

I hope I need not say that my view of the transformation was a more radical one than this.

My previous opinion of the B.P. Ung. Hydrarg. Ammon. was that it was a valuable adjunct to treatment, allaying impetiginous complications, but with perhaps one exception (Lester Shaw's case) I have not relied on it as a curative agent of high order.

I have a young child at present under the same treatment for extensive microsporon infection, but all that seems to be achieved here is the quieting of irritability of the scalp. I have noticed no sensible diminution of the affected areas for several weeks.

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I have at length outgrown in my experience of ringworm treatment, the feeling which used to possess me in reading enthusiastic accounts of various drugs by their special advocates, that my previous treatment had lacked the one essential, or had been characterised by some special error. The question of shaving and washing instances this well. I had had all my cases shaved; and they were scrubbed each morning for some time, but on reading Mr. Malcolm Morris's denunciation of this, I began to wonder if the disease had thereby been extended, and I ceased to shave and wash with such ardour.

Again, I was influenced by the high praise of chrysarobin by Unna and Morris, and instituted this treatment at the cost of staining much bed linen and many garments, the sacrifice of which I reckoned as nothing, compared to the inestimable advantages which were to ensue from its use.

Its results, however, did not come up to my expectations, though I do not deny its value. I found it a much less dangerous remedy than I had supposed. The children's ~~faces~~ brows were often stained a deep purplish colour, but I can recall no regrettable incident except the damage to clothing, in connection with its use. If the ointment actually got inside the eye, Conjunctivitis was produced, but this very rarely happened, and was not serious.

Its chief apparent property seemed to be its discutient action, which I never found unduly severe. As stated elsewhere it seemed to keep patches from which obvious stumps had been removed, clear.

I have mentioned several cases in which I found croton oil to be by far the most effective remedy used. I should like to state concerning it, that though the scalp after its application may look much inflamed I cannot remember causing any serious scarring with it. (Charles Pearce's scalp was not damaged, though cellulitis and abscess followed its use, as described elsewhere.)

From the child's standpoint, it is much less painful than the formalin treatment as Aldersmith has insisted.

As a rule, a child having a patch of moderate size which was being thus treated, did not complain of pain during the time of reaction to the irritation.

I should not think of employing croton oil in the treatment of out-patients, and I should never depute the application of the oil to the scalp, to a nurse or guardian, as very serious mischief might follow its incautious use.
Besides having much faith in this "indirect" method, I think if some local anaesthetic action could be safely procured, that dissolving the superficial epidermis by rubbing with liquor potassae, and (thus getting an entrance to the abode of the fungus) and then applying antiparasitic remedies, would cure

quite as quickly. I have tried this direct method and have found it eminently successful, but it is very painful, and if a child is wriggling, one is apt to override the solvent action, and thus cause permanent loss of hair.

Aldersmith quotes a case undergoing "Harrison's treatment," where a nurse left the potash solution on too long, thereby producing a scar, three inches by two. This indicates that the treatment with these dangerous remedies was in the hands of a nurse. I think that, carefully employed, Harrison's method (though I should not use perchloride of mercury) might be revived with benefit, if doctors only used it, and one could diminish the pain, as above suggested.

Theoretically - salicylic and collodion applications should effect this solution of the epidermis, and also kill the fungus, but practically I have found it very slow in eradicating the disease, and do not think that the antiseptic element comes into close contact with the spores.